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Bulletin No. 323 - 347 September 1938

A Compilation
OF EXPERIMENTAL
DATA

357
28

COTTON

Land Preparation, Planting and Cultivation

132842

Compiled by
E. E. Gross
Coordinator Research Information

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I. INTRODUCTION

This compilation of experimental data on the preparation of land for planting cotton, the planting of cotton and the cultivation of cotton has been selected from a limited amount of published material along these lines. Local information and practices should be used to supplement the material in this publication.

The importance of preparation of the land for planting and the cultivation of cotton is emphasized when we note the results of the experiments in this publication. The results in the tests on methods showed increases in yields ranging up to 585 younds seed cotton per acre.

The cooperation of Mr. J. F. O'Kelly and Mr. T. N. Jones of the Mississippi Agricultural Experiment Station was a great help in preparing this publication and the evaluation of the material as to educational value by Professor V. G. Martin and staff of the Agricultural Education Department of Mississippi State College, aided in the presentation of the material.

II. PREPARATION OF LAND FOR THE PLANTING OF COTTON

PREPARING LAND FOR PLANTING COTTON ON MISSISSIPPI DELTA SOILS

Conducted by: Mississippi Delta Experiment Station.

Conducted at: Stoneville, Mississippi.

Period: (1926-32) for buckshot soil
(1929-32) for loam soil

Purpose: To test effect of different methods of land preparation on the yield of cotton.

Soil: (Buckshot soil)
(Loam soil)

Procedure and Conditions: In these tests, spring work was done 2 to 3 weeks before planting. All beds were tandem disked and dragged before planting. This helped fall-prepared plots more than would average plantation practices, but clean beds are essential to proper planting.

Good plowing is necessary to kill perennial plant pests and to pulverization. On buckshot it is safer and easier to plow in the fall or early spring, thereby making perfect planting and cultivation possible at minimum expense. On average soils beds are essential to good stands.

Low yields were obtained in all test plots in 1932.

Results:

Preparing Land for Planting Cotton on Mississippi Delta Soils

Method of Preparation	Buckshot Soil					Loam Soil				
	Lbs. Seed Cotton Per Acre			Percent Increase		Lbs. Seed Cotton Per Acre			Percent Increase	
	1932		Average Yield 1926-32	1932	Average	1932		Average Yield 1929-32	1932	Average
	Actual Yield	Corrected Yield				Actual Yield	Corrected Yield			
M. B. Fall, 3 furrows spring (Ck)	545.9	576.6	1352.8			716.2	737.6	1152.2		
1 H.M.B. in old middles spring	634.2	643.3	1276.9	11.56	-5.61	658.6	655.7	1016.4	-11.09	-11.79
(1) 4 H. M. B. in fall only	614.4	599.4	1340.5	3.96	- .91	735.1	708.5	1119.7	- 3.94	- 2.98
Same when soil is very wet	621.6	584.2	1329.3	1.32	-1.74	781.1	729.4	1051.3	- 1.11	- 8.76
M. B. Fall, 3 furrows spring (Ck)	636.0	576.6	1352.8			814.4	737.6	1152.2		
Bed with 3 furrows in fall	648.6	597.7	1297.6	3.66	-4.08	793.7	720.0	1055.6	- 2.38	- 8.38
Same when soil is very wet	573.0	536.9	1283.9	-6.88	-5.09	827.0	751.5	1068.5	1.88	- 7.26
List fall, balk in spring	591.0	563.3	1316.4	-2.30	-2.69	779.3	709.3	1080.7	3.83	- 6.20
M. B. Fall, 3 furrows spring (Ck)	594.6	576.6	1352.8			809.0	737.6	1152.2		
Flatbreak 3", disc bed fall	556.8	555.0	1329.9	-3.73	-1.69	741.4	720.1	1149.7	- 2.36	- 0.21
Flatbreak 6", disc bed fall	591.0	606.2	1332.9	5.13	-1.47	797.3	828.4	1203.6	12.31	4.46
Same except bed in spring	571.2	603.2	1387.2	4.62	2.54	783.3	824.6	1169.8	11.79	1.52
M. B. Fall, 3 furrows spring (Ck)	529.7	576.6	1352.8			610.8	737.6	1152.2		

(1) 4 H.M.B. is 4 horse middle buster abbreviated.

Reference: Mississippi Agricultural Experiment Station Service Sheet 106, "How and When Should Cotton Lands Be Prepared for Safety and Economy," March 10, 1933, Stoneville, Mississippi.

Suggestive: Which method of preparation produced the greatest yield on each of the soils? How would labor supply influence time of preparing land? How would weeds and grasses be a factor in the preparation of land for planting? Which of these methods is nearest to that commonly used on your farm? How does the yield from this method compare with other methods in the test?

EFFECT OF SEED BED PREPARATION ON YIELD OF COTTON ON HOUSTON CLAY SOIL

Conducted by: Mississippi Agricultural Experiment Station and Bureau of Agricultural Engineering, United States Department of Agriculture.

Conducted at: West Point, Mississippi.

Period: 1932-1937

Purpose: To determine the best method of preparing land for planting cotton on Houston clay soils.

Soil: Houston clay.

Procedure and Conditions: This test was run in two series, one series shallow and one deep. Since the depth of operations is the only difference the results are tabulated so that deep and shallow preparation comparison can be made on each method.

All plots received 400 pounds of 6-8-4 fertilizer per acre. The planting was done with a tractor operated combination planter and fertilizer distributor which also put out the fertilizer at the same operation.

The cultivation was done with a two row tractor cultivator with all plots getting same cultivation. The first two cultivations were done with disc hillers next to the cotton and small sweeps on the rest of the gang. In the next two cultivations six inch sweeps were used next to the cotton with eight and ten inch sweeps completing the gang. The cotton received an average of six cultivations per year with the last cultivations being done with large sweeps. The sweeps were of the best material and were kept sharp.

The stalks were all cut with a stalk cutter in the fall. The "plow" operation was flat breaking with a disc plow. The "disc (orchard)" operation was done with an ordinary six gang disc with the disc reversed and set to fit bed.

Draft was measured with a recording dynamometer. From the draft of each implement the horse power hours were calculated on a basis of 40 inch row.

Results:

Effect of Seed Bed Preparation on Yield of Cotton on Houston Clay Soil

Method No.	Operation	Date of Operation	Draft Per 40" Row		Depth of Operation		Horse Hours Per Acre		Hoe Labor Per Acre		Yield Seed Cotton Per Acre	
			Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow
1---Check	Plow	Fall	3568	2305	7.1	4.6						
	Disc	Fall	579	466	4.1	3.1						
	Bust Middle	Fall	1270	679	7.4	4.0						
	Disc	Fall	506	456	3.2	3.0						
	Harrow Beds	Spring	749	701			44.0	30.4	12.7	12.7	837	842
2	Disc	Winter	604	443	2.9	2.5						
	Plow	Winter	3926	2501	5.0	4.8						
	Bust Middle	Winter	1337	712	6.9	3.9						
	Disc (Orchard)	Spring	468	410	2.8	2.8						
	Harrow Beds	Spring	747	700			46.7	31.4	13.8	13.1	935	930
3	Disc	Fall	588	507	2.5	2.6						
	Plow	Fall	4266	2664	7.0	4.5						
	Disc	Fall	443	492	3.5	2.9						
	Disc	Spring	513	538	3.5	3.5						
	Disc	Spring	569	538	3.5							
	Bust Middle	Spring	1294	835	7.3	5.0						
	Disc (Orchard)	Spring	501	402	3.0	3.0						
	Harrow Beds	Spring	747	700			58.0	44.0	13.0	12.2	929	914
4	Bust Row	Fall	1596	751	7.3	4.3						
	Subsoil	Fall	2260	1558	15.0	11.0						
	Bust Middle	Spring	1465	715	7.5	4.1						
	Harrow Beds	Spring	748	700			40.5	24.5	12.3	12.9	970	923
5	Bust Row	Spring	1562	777	7.4	4.3						
	Subsoil	Spring	2181	1644	13.2	9.4						
	Bust Middle	Spring	1437	744	7.0	4.3						
	Harow Beds	Spring	748	701			39.1	25.5	11.7	12.2	908	862
6	Bust Row	Winter	1527	905	7.0	4.4						
	Bust Middle	Winter	1359	824	7.1	4.7						
	Harrow Beds	Spring	749	701			23.9	16.0	12.5	14.6	942	788

Method No.	Operation	Date of Operation	Draft Per 40'' Row		Depth of Operation		Horse Hours Per Acre		Hoe Labor Per Acre		Yield Seed Cotton Per Acre	
			Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow
7	Bust Row	Spring	1513	787	7.1	4.1						
	Bust Middle	Spring	1646	729	7.3	4.1						
	Disc (Orchard)	Spring	463	378	3.0	3.1						
	Harrow Beds	Spring	749	701			28.8	17.1	12.1	12.9	887	734
8	Bust Middle	Winter	1518	845	6.7	4.3						
	Disc (Orchard)	Winter	496	402	3.0	2.8						
	Harrow Beds	Spring	749	626			18.2	12.3	15.1	16.3	938	773
9	Bust Middle	Spring	1576	777		4.1						
	Disc	Spring	690	406		3.0						
	Harrow Beds	Spring	749	701			19.8	12.4	17.4	19.5	812	806
10	Bust Middle	Winter	1488	835	6.6	4.1						
	Harrow Beds	Spring		701			14.7	10.1	13.8	19.8	785	923
11	Bust Middle	Spring	1757	668	6.8	4.0						
	Harrow Beds	Spring	747	700			16.5	9.0	15.3	19.7	806	892
12	Disc	Fall	594	510	2.7	2.8						
	Plow	Fall	3714	2262	7.2	4.6						
	Disc	Winter	472	675	3.7	2.8						
	Bust Row	Spring	1238	939	7.3	4.3						
	Bust Middle	Spring	1519	967	8.1	4.8						
	Disc	Spring	496	410	3.5	3.0						
	Disc (Orchard)	Spring	492	398	3.5	3.0						
	Harrow Beds	Spring	750	702			61.2	45.2	11.7	12.5	787	803
13	Disc	Spring	571	524	3.3	2.8						
	Plow	Spring	3549	2482	6.5	5.0						
	Disc	Spring	997	808	4.1	2.8						
	Bust Row	Spring	1235	702	7.3	4.9						
	Disc	Spring	496	397	3.1	3.0						
	Bust Middle	Spring	1215	617	6.3	5.4						
	Disc (Orchard)	Spring	1013	399	3.5	3.1						
	Harrow Beds	Spring	731	703			64.8	43.7	11.5	13.2	758	792

The above figures are based on a six year average, 1932-1937 inclusive.

Reference: Data from field experiment on seed bed preparation and cultivation conducted by Agricultural Engineering Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

Suggestive: Which method produced largest yield when plowed shallow? Which method produced largest yield when plowed deep? How does the labor required per acre compare in the three highest yielding methods in the deep and shallow plowing?

EFFECT OF SEED BED PREPARATION AND CULTIVATION ON YIELD OF COTTON ON HOUSTON CLAY SOIL

Conducted by: Mississippi Agricultural Experiment Station and Bureau of Agricultural Engineering, United States Department of Agriculture.

Conducted at: West Point, Mississippi.

Period: 1932-1937

Purpose: To determine which method of preparation of land for cotton and cultivation produced cotton most economically on Houston clay soil.

Soil: Houston clay.

Procedure and Conditions: The operations studied in the test were in the spring and with mules instead of tractors. Stalks were cut in fall on all plots except in Method 400 and 401, which were pulled by hand. The "plow" operation was flat breaking. The "disc (orchard)" operation was done with an ordinary six gang disc with the disc reversed and set to fit the bed.

In Method 400 the stalks were pulled by hand and the only preparation was with the drag harrow. No cultivation was given in Method 400, the weeds and grass being controlled with the hoe. All methods received the same treatment in planting and in applying the 400 pounds of 6-8-4 fertilizer per acre.

In Method 401 the procedure was the same as in 400 except that this method was cultivated as the other methods in this test.

The cultivations average six per year and were done with a two row tractor cultivator. The first two cultivations were done with disc hillers next to the cotton and small sweeps on the rest of the gang. The next two cultivations were done with six inch sweeps next to cotton with eight and ten inch sweeps completing the set. The last cultivations were done with large sweeps. (The sweeps used were of the best materials and were kept sharp.)

Results: Effect of Seed Bed Preparation and Cultivation On Yield of Cotton on Houston Clay Soil

Method	Operation	Horse Power Hours Per Acre Seedbed Preparation and Cultivation	Hoe Labor Per Acre	Yield Per Acre
400	Drag Harrow (with no cultivation)	.92	76.2	966
401	Drag Harrow	13.1	16.3	916
402	Streak Off Drag Harrow	18.3	12.7	910
403	Streak Off Disc (Orchard) Drag Harrow	22.1	11.9	936
404	Bust Row List (4 furrows) Bust Balk Drag Harrow	31.6	11.4	944
405	Disc Plow Disc Disc Disc Drag Harrow	50.1	11.5	897
406	Disc Plow Disc Disc Disc Streak Off Drag Harrow	62.0	11.5	840
407	Streak Off Disc Drag Harrow Streak Off Drag Harrow	36.4	12.4	856
408	Middle Bust Middle, List Back, Middle Bust Balk	52.3	12.7	864
409	Disc Drag Harrow	19.7	26.6	769
410	Disc Streak Off Drag Harrow	24.0	20.5	788
411	Disc Streak Off Disc (Orchard) Drag Harrow	25.9	17.4	785
412	Disc Bust Row List Back (4 furrows) Bust Balk Drag Harrow	34.4	13.9	822

Method 400 gave the highest yield in this test but during the six years the infestation of Bermuda and Johnson grass increased from 10% of the area of the plot to 90% of the plot. The hoe labor necessary to keep weeds and grass in check increased each year. The crawfish infestation on plot 400 increased to such an extent that 70% of the plot had to be replanted in 1936 and 1937.

Reference: Data from field experiment on seed bed preparation and cultivation conducted by Agricultural Engineering Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

Suggestive: Which method produced highest yield in this test on Houston clay soil? Which method had large increase in grass and weed infestation? Which method had to be replanted on account of crawfish damage? Which method ranked highest in the economical production of cotton?

SEED BED PREPARATION FOR PLANTING COTTON IN LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: North Louisiana Experiment Station, Calhoun, Louisiana.

Period: 1931-1934

Purpose: To study the effect of three different methods of seed bed preparation on the yield of cotton.

Procedure and Conditions: The first method used was "a well prepared, thoroughly broken seed bed." In the second method "a middle burster was used to lay off the row and to re-bed after applying fertilizer." Under the third method used, the fertilizer was applied on hard ground and bedded on with a middle burster.

All three plans received the same fertilization and cultivation.

Results: **Seed Bed Preparation**

Preparation	1931	1932	1933	1934	4 Yr. Av.
Well-broken seedbed	1057	1203	1091	1031	1096
Bedded on middle burster furrow	1106	1153	924	766	987
Bedded on hard ground	944	881	632	643	775

Reference: North Louisiana Agricultural Experiment Station Annual Report for the year 1935, page 9, Calhoun, Louisiana.

Calhoun, Louisiana is approximately 90 miles West of Vicksburg, Mississippi.

Suggestive: Which method made the highest yield? Assuming that your conditions are similar to the above could you increase your yields by better seed bed preparation?

METHODS OF LAND PREPARATION FOR COTTON IN ALABAMA

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: 1925-1931

Purpose: To study the different methods of preparing land for cotton.

Soil: Norfolk sandy loam.

Procedure and Conditions: The land "broken deeply" was turned with a two-horse turn plow. The land "broken shallowly" was turned with a turn shovel or as may be commonly called "twister." The land was bedded in either case with a middle buster.

Results: Average Yield of Cotton in an Experiment Comparing Different Methods of Land Preparation, 1925-1931

Plot No.	Method of Preparation	Fertilizer Applied	7 Yr. Av. Yields Seed Cotton in Lbs. Per Acre
1	Check---land not broken	Check---in a shallow furrow and bedded on	914
2	Broken deeply	In a shallow furrow and bedded on	1,031
3	Broken deeply	In a deep furrow and bedded on	1,032
4	Broken deeply	With seed on a bed made by laying off rows with a middle buster	1,020
5	Check---land not broken	Check---in a shallow furrow and bedded on	828
6	Broken shallowly	In a shallow furrow and bedded on	888
7	Broken shallowly	In a deep furrow and bedded on	934
8	Broken shallowly	With seed on a bed made by laying off rows with a middle buster	951
9	Check---land not broken	Check---in a shallow furrow and bedded on	890
10	Not broken	In a shallow furrow and bedded on	892
11	Not broken	In a deep furrow and bedded on	919
12	Not broken	With seed on a bed made by throwing two furrows to the old row with a turn plow	951
13	Check---land not broken	Check---in a shallow furrow and bedded on	931

Reference: Alabama Agricultural Experiment Station Forty-third Annual Report, pages 10 and 11, table 1, Auburn, Alabama and correspondence from E. L. Mayton, Assistant Agronomist, Department of Agronomy and Soils, Auburn, Alabama, January 6, 1938.

Suggestive: How much did deep breaking increase the yield of seed cotton per acre in this test on Norfolk sandy loam? Which method of applying fertilizer produced greatest yields when land was broken deeply? Which method of applying fertilizer produced greatest yields when land was broken shallowly?

EFFECTS OF SEED BED PREPARATION METHODS ON YIELD OF COTTON

Conducted by: U. S. Bureau of Agricultural Engineeding and the Alabama Agricultural Experiment Station.

Conducted at: Prattville, Alabama.

Period: 1932-1936

Purpose: To obtain information on the best method of seed bed preparation.

Soil: Red Bay fine sandy loam. The findings set forth will have more or less direct application to several million acres of the coastal plains soils that have textural and structural properties similar to this Red Bay fine sandy loam though classified under other names.

Procedure and Conditions: The Bureau's variable depth system of cotton planting was used on all tillage experimental plots and an ample stand was obtained with the first planting on each plot each year. The Bureau's one-operation method of cotton planting consists in cutting the seed bed to the desired heights with a sweep shaped to give the bed a slight crown and then planting the seed with the variable-depth planter.

Results: **Effects of Seed Bed Preparation Methods on Red Bay Fine Sandy Loam on Yield of Cotton**

Method No.	Machine Operations. (With disk harrow, 10" middle buster, 9" and 14" moldboard plows)	Approximate Date of Work	5 Year Average Data	
			Horse-Power Hours Per Acre	Seed Cotton in Pounds Per Acre (1)
402	No machines used; stalks handpulled, weeds hoed out, 44 man-hours per acre. Cultivated as other plots		0.0	1,100
411	1. Double disk 2. Double disk 3. Bust middle 4" deep 4. Knock down beds (2)	March 1 March 20 March 30 April 15	12.7	1,138
612	1. Cut stalks 2. Bust middle 4" deep 3. Pull roots 4. Knock down beds (2)	Fall Dec. 20 April 15	4.9	1,024
609	1. Cut stalks 2. Bust out old row 4" deep 3. Bust middle 4" deep 4. Knock down beds (2)	Fall Feb. 20 March 20 April 15	7.6	1,135
509	1. Cut stalks 2. Bust out old row 8" deep 3. Bust middle 8" deep 4. Smooth	Fall Feb. 20 March 20 April 15	21.8	1,238
608	1. Cut stalks 2. Bust row 4" deep 3. List back two furrows 4" deep 4. Bust middle 4" deep 5. Smooth	Fall Feb. 20 March 20 April 1 April 15	11.9	1,112
508	1. Cut stalks 2. Bust row 8" deep 3. List back 8" deep 4. Bust middle 8" deep 5. Smooth	Fall Feb. 20 March 20 April 1 April 15	32.1	1.247
505	1. Cut stalks 2. Bust row 8" deep 3. Subsoil with 3" furrow 8" deep 4. List back 8" deep 5. Bust middle 8" deep 6. Smooth	Fall Feb. 20 Feb. 25 March 20 April 1 April 15	41.3	1,258
607	1. Cut stalks 2. Bust row 4" deep 3. List back 4" deep 4. Bust middle 4" deep 5. Smooth	 Jan. 10 Jan. 30 Feb. 15 April 15	9.7	1,147

Method No.	Machine Operations. (With disk harrow, 10" middle buster, 9" and 14" mold-board plows)	Approximate Date of Work	5 Year Average Data	
			Horse-Power Hours Per Acre	Seed Cotton in Pounds Per Acre (1)
507	1. Cut stalks			
	2. Bust row 8" deep	Jan. 10		
	3. List back 8" deep	Jan. 30		
	4. Bust middle 8" deep	Feb. 15		
	5. Smooth	April 15	26.0	1,312
601	1. Cut stalks	Fall		
	2. Plow broadcast 4" deep	Jan. 10		
	3. Bed with cultivator	April 1		
	4. Smooth	April 15	12.6	1,196
501	1. Cut stalks	Fall		
	2. Plow broadcast 8" deep	Jan. 10		
	3. Bed with cultivator (3)	April 1		
	4. Smooth	April 15	26.3	1,333

(1) Weighted for soil variability and average of two plots, except 601 and 501 average of 8 plots which are used as checks to measure soil veriability.

(2) Wooden drag float used to knock off bed top for conventional planting.

(3) Bedded with cultivator equipped with 4-14" disk hillers per row.

The five-year average yields for all methods of seed bed preparation used varied from 959 to 1,333 pounds of seed cotton per acre. This difference of 374 pounds per acre is believed to be primarily due to the differences produced in the soil structure. The power required to prepare an acre of cotton land by the different methods studied varied from 0 to 93 horsepower hours. The time required to keep down weeds, chop and do other operations, except picking, varied from 18 to 122 man hours.

The results show that a cloddy seed bed produced by working the soil deep when relatively dry and then allowing it to settle and mellow some time before planting produces more cotton than shallow or excessive tillage operations. Thus it is indicated that the primary value of tillage is in helping natural agencies produce an optimum "Tilth," and that excessive pulverization destroys desirable soil structure conditions. The seed bed preparation methods producing the best cotton caused the soil to maintain an open granular structure throughout the crop season as shown by detailed measurements of the soil's physical condition. It was noted that for such a soil condition the cotton yield was affected the least by dry weather during the growing season. It will be found, however, that soils vary in their ability to assume semi-permanent structure that will aid crop production. The method found best on this type of soil may not be best for other types.

Broadcast plowing with good inversion has proved beneficial in the control of many annual weeds.

Reference: Mimeograph No. 3051, "Parts Played by Tillage Equipment and Tillage Methods on Yield of Cotton on Red Bay Fine Sandy Loam," pages 3, 4, 5, 6, 9 and 10, Table 2, Statement by John W. Randolph Agricultural Engineer, U. S. Bureau of Agricultural Engineering, before the Farm Equipment Institute, Chicago, Illinois, December 2, 1937.

FERTILIZER PLACEMENT IN CONNECTION WITH SEED BED
Preparation for Cotton

Conducted by: Mississipp Delta Experiment Station.

Conducted at: Stoneville, Mississippi.

Period: 1929-1935.

Purpose: To test effect of fertilizer placement in connection with seedbed preparation on the yield of cotton.

Soil: Sharkey sandy loam which is an alluvial soil located in the Yazoo-Mississippi Delta at Stoneville, Mississipi.

Procedure and Conditions: The fertilizers used in this experiment were Cyanamid and Calcium Nitrate, and they were applied at the rate of thirty pounds of Nitrogen per acre. These two fertilizers were selected because they are the least and most soluble respectively, of the Sources of Nitrogen commonly used in the Yazoo-Mississippi Delta. Should these two fertilizers show a wide variation in their crop producing ability, in accordance with their solubility, where different placements are used, the other commonly used Nitrogenous fertilizers could be arranged in between these two extremes in accordance with their solubility for a given placement.

Since there is no machinery in this section to apply fertilizer successfully at the time of planting, and it is desirable to have a firm bed to plant on, it is the common practice to apply the fertilizer before the seed beds are prepared and "bed on" it. Consequently with those ideas in mind, seven different placements were chosen, and six replications with each fertilizer used.

Results: Yearly Yields and Averages of Fertilizer Placement Experiment

Placements	Pounds of Seed Cotton Per Acre							
	1929	1930	1931	1932	1933	1934	1935	7 Yr. Av. 1929-35
				Calcium Cyanamid				
On bed---disk in	1864.1	899.1	972.3	706.2	1531.8	969.0	1004.7	1135.3
In buster furrow	1859.2	874.2	1025.1	762.7	1528.4	952.5	934.7	1133.8
In shovel furrow)								
In buster furrow)	1860.9	925.7	996.7	692.2	1638.0	1025.6	961.7	1157.2
On the list	1873.9	776.4	1036.6	705.4	1500.4	954.3	936.0	1111.9
Broadcast on beds	1829.9	939.6	938.6	706.4	1668.4	1050.3	993.6	1161.0
Broadcast before rebedding	1784.9	672.7	1007.5	778.6	1601.7	1011.3	1035.7	1127.5
In furrow on beds	1809.1	731.3	1021.0	729.7	1475.4	1006.3	998.4	1110.2
				Calcium Nitrate				
On bed---disk in	1807.6	1004.0	1017.6	783.6	1353.9	877.2	849.3	1099.0
In buster furrow	1837.7	1164.6	1175.1	880.0	1389.8	881.5	871.4	1171.4
In shovel furrow)								
In buster furrow)	1796.6	1173.3	1147.8	854.0	1454.3	1000.6	951.4	1196.6
On the list	1788.1	1035.4	1115.7	816.9	1386.8	963.7	949.1	1150.8
Broadcast on beds	1843.8	781.4	969.3	769.3	1382.3	886.5	838.9	1053.1
Broadcast before rebedding	1720.0	779.9	1073.8	840.0	1284.5	820.5	663.4	1026.0
In furrow on beds	1698.2	847.3	1099.0	828.1	1292.8	827.1	656.8	1035.6

Reference: Mississippi Agricultural Experiment Station Service Sheet 185, "Fertilizer Placements in Connection with Seed Bed Preparation for Cotton," March 1936, Stoneville, Mississippi.

Suggestive: Why is the fertilizer placement a factor in seed bed preparation? Which method produced the greatest yield when calcium cyanamid (least soluble of two tested) was used? Which method produced the greatest yield when calcium nitrate (most soluble of two tested) was used?

SEED BED PREPARATION AND TILLAGE EXPERIMENT WITH COTTON AT JACKSON, TENNESSEE

Conducted by: Tennessee Agricultural Experiment Station.

Conducted at: West Tennessee Branch Experiment Station, Jackson, Tennessee.

Period: 1917-1929

Purpose: To try out various methods of soil preparation and crop cultivation.

Soil: Lintonia.

Procedure and Conditions: This land has grown cotton and corn continuously.

Experiment No. 4 can be taken as the model or standard of comparison. In this case the land was plowed or "flat-broken" early in the spring to a depth of 6 inches. It was afterward well harrowed and rolled. About 10 days before planting, 3 foot rows were marked off and "bedded;" that is, a low ridge was made over each row. The tops of the rows were harrowed down just before planting. After the cotton was up the cultivation was that commonly recognized as good. As a rule the first working consisted either of cross-harrowing with a spike tooth harrow, or running a scraper as close to the plants as possible, throwing the dirt away from them. The latter operation is known as "barring off." Hoeing and chopping to a stand followed as soon as possible. The after-tillage depended on the conditions, but the objects were to prevent the growth of weeds and grass, maintain low ridges on which the plants grow and are kept out of the water, and to leave a surface mulch of loose dirt. As a rule only shallow-working implements were used.

A noticeable result following the growing of cotton continuously without turning the land as was the case in No. 1, was the increase of diseased plants.

Results: **Results from 12 Years of Tillage Experiments with Cotton at Jackson, Tennessee**

Year	No preparation, weeds scraped off	Turned 6 inches. Bedded. Weeds scraped off	No preparation. Good cultivation	Turned 6 inches. Bedded. Good cultivation	Turned 3 inches. Level planting. Good cultivation	Turned 6 inches. Level planting. Good cultivation	Bedded 3 inches. (1 horse plow.) Good cultivation	Bedded 6 inches (2 horse plow.) Good cultivation
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1917	1320	1800	1600	1710	1480	1460	1740	1580
1918	850	1070	840	970	980	1060	790	915
1919	1500	1925	1890	2030	2090	1910	1770	2000
1920	772	985	1253	1222	1549	1660	1370	1371
1921	1080	2800	1800	2680	2920	2440	2880	2680
1922	1150	1780	1360	1660	1380	1460	1640	1280
1923	1100	1500	1160	1440	1400	1450	1235	1090
1924	625	1155	785	1095	1105	1220	1040	1135
1925	904	1549	1204	1500	1340	1300	1349	1239
1926	1240	1896	1296	1856	1400	1472	1408	1608
1928	648	1112	896	1208	1272	1376	1024	1392
1929	1176	1808	1448	1808	1792	1680	1536	1568
Av.	1030	1615	1294	1598	1559	1541	1482	1488

Reference: Tennessee Agricultural Experiment Station Bulletin 127 and Mimeograph "Tillage Experiments with Cotton," West Tennessee Experiment Station, Jackson, Tennessee.

Suggestive: Which gave highest yield in the test? Is it practical for a farmer to scrape his field to control grass and weeds? What method ranked second and third in the test?

III. PLANTING COTTON

COTTONSEED TREATMENT TEST IN SOUTH CAROLINA

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Pee Dee Experiment Station Florence, South Carolina.

Period: Five years, 1930-1934

Purpose: To determine the effect of delinting and dusting cotton seed upon the yield of seed cotton.

Results: Cottonseed Treatment in South Carolina

Treatment	Average Yield for Five Years
Normal seed	1651.6
Normal seed plus Ceresan	1792.6
Acid-delinted	1821.2
Acid-delinted plus Ceresan	1848.4
Machine-delinted	1713.5
Machine-delinted plus Ceresan	1765.1

When seed are treated with dust they do not rot as quickly if weather conditions are not favorable for germination and improved stands have resulted. Plants from dusted seed have been freer from sore-shin disease, angular leaf spot, and anthracnose than have plants from untreated seed.

Reference: South Carolina Agricultural Experiment Station Forty-Eighth Annual Report (1935) pages 86 and 87, Clemson, South Carolina.

EFFECT OF SEED TREATMENT ON YIELD OF COTTON IN LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station in cooperation with United States Department of Agriculture.

Conducted at: Baton Rouge, Louisiana.

Period: Two years, 1935-1936

Purpose: To determine the effect of seed treatment on yield of cotton.

Results: Seed Treatment Studies

Treatment	Average Percent Emergence	Yield Lbs. Seed Cotton per Acre
Four ounces dust per bushel seed		
Ceresan	69.2	1387
Improved Ceresan	43.2	1475
Sulphuric acid delinted	41.0	1238
Sulphuric acid delinted plus Ceresan	47.7	1188
Red Copper Oxide	38.6	1525
Meltrox	39.1	1575
Untreated	34.4	1363
Two ounces dust per bushel seed		
Ceresan	49.8	1225
Improved Ceresan	48.7	1250
Red Copper Oxide	36.6	1175
Untreated	32.9	1063

Reference: Louisiana Agricultural Experiment Station Bulletin 283, "Crops and Soils Information," page 12, table 4, March 1937, Baton Rouge, Louisiana.

THE EFFECT OF VARYING PLANTING DATES ON YIELD OF COTTON IN THE MISSISSIPPI DELTA

Conducted by: Delta Branch Experiment Station.

Conducted at: Stoneville, Mississippi.

Period: 9 years, 1929-1937

Purpose: To determine the best date to plant cotton in the Mississippi Delta.

Results: **Effect of Varying Planting Dates on Yield of Cotton**

Date of Planting	Acre Yield in Pounds Seed Cotton	
	7 Year Average 1929-1937 Excluding 1934 and 1935*	9 Year Average 1929-1937
April 1	1504.5	1170.1
April 15	1745.5	1589.2
May 1	1447.1	1510.7
May 15	1308.2	1310.0
June 1	951.3	915.0
June 15	306.2	328.8
July 1	41.2	32.0
July 15		

*In 1934 April 1, and April 15, planting was killed. In 1935 April 1, planting was killed.

Reference: Mimeograph, "Some Highlights on the Work of the Delta Branch Experiment Station, Stoneville, Mississippi," issued in 1938.

DATE OF PLANTING COTTON IN MISSISSIPPI

The best date for planting cotton at a given location in the cotton belt varies greatly with the season and, to a less extent, with soil type. In the central part of the Mississippi Delta cotton was planted at 5-day intervals from March 25 to the middle of May for a series of years. The best time was found to be between April 10 and 20, with little difference in yields secured from plantings made at different times between those dates. Plantings made before or after those dates gave considerably less yield, and the farther removed from the date the lower the yield. Similar results were obtained at Florence, South Carolina, where the best planting date was found to be the first week in April. At State College it is sometimes safe to plant during the first week in April. In other seasons it may be impossible to begin before April 25. The best average date lies between April 10 and 20. The best planting date for points south of State College may be 10 to 15 days earlier while points north may be 5 to 10 days later.

The well drained black soils of the Prairie section usually become warm enough for planting before sandy soils in the same latitude.

The only conclusion one can safely form is that cotton planting should be started as soon as the soil becomes warm enough for prompt germination and should be completed as soon thereafter as possible.

Reference: Mississippi Agricultural Experiment Station Information Sheet 34, "Date and Rate of Planting Cotton," March 1934, State College Mississippi.

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DATE OF PLANTING COTTON IN LOUISIANA

Conducted by: Northeast Louisiana Experiment Station.

Conducted at: St. Joseph, Louisiana.

Period: Two years, 1930-1931

Purpose: To determine the approximate date or dates of planting for the best yield of cotton.

Soil: Fairly good sandy loam.

Land History: The land has been planted continuously to cotton for many years.

Procedure and Conditions: One hundred pounds of Chilean nitrate of soda was applied before planting (bedded on) and 100 pounds applied as a side-dressing after chopping.

Express 317 cotton was used. The cotton was planted March 17 both years, came up to only fair stand and suffered some loss from drying. 1930 was an unusually dry summer, and 1931 very rainy during the fruiting season. These conditions affected the yield of the late plant very materially.

Results: Date of Planting Cotton in Louisiana

Date Planted	Yield 1930	Yield 1931	Average 2 Years (Pounds)
March 17	975	1,575	1,275
April 1	1,923	1,972	1,947
April 15	1,637	1,570	1,603
May 1	1,950	1,188	1,569
May 15	1,737	963	1,350
June 2	2,165	277	1,221
June 15	428	104	266

Reference: Northeast Louisiana Experiment Station Biennial Report 1930-1931, pages 5 and 6, St. Joseph, Louisiana.

EFFECT OF DATE OF PLANTING ON YIELD OF COTTON

Conducted by: North Louisiana Experiment Station.

Conducted at: Calhoun, Louisiana.

Period: Four years, 1933-1936

Purpose: To determine the best date of planting cotton.

Results: Date of Planting Cotton Test

Planting Date	1936 Results Seed Cotton Per Acre	Four Year's Average Results Seed Cotton Per Acre
March 15	1184*	
March 30	1262	826
April 15	1147	850
April 30	1075	804
May 15	721	654
May 30	540	452
June 10		171**

*Results for one year

**Average for three years

Reference: Biennial Report of the North Louisiana Experiment Station, page 7, table 6, 1935-1936, Calhoun, Louisiana.

EFFECT OF DATE OF PLANTING ON YIELD OF COTTON IN LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge, Louisiana.

Period: One year, 1933 and a five-year average.

Purpose: To determine the best date for planting cotton.

Soil: Bench land, medium fertility.

Procedure and Conditions: The cotton in this test was planted on medium fertile land and given the normal culture for the region, the only exception being the variable planting date. The planting dates were April 1, 11, 21 and May 1 and 11.

Results: **Date of Planting Cotton**

Planting Date	Blooming Date	Days from Planting to Blooms	Bolls Open	Days from Blooms to Open Bolls	Pounds Seed Cotton Per Acre 1933	Pounds Seed Cotton Per Acre 5-Year Average
April 1	June 5	65	July 26	51	1819	1646
April 11	June 11	61	July 31	50	1780	1715
April 21	June 17	57	August 2	46	2191	1792
May 1	June 23	53	August 11	49	1086	1628
May 11	July 3	53	August 24	52	834	1446

Reference: Louisiana Agricultural Experiment Station Bulletin 283, "Crops and Soils Information," pages 13 and 14, table 6, March 1937, Baton Rouge, Louisiana.

RATE OF PLANTING COTTON SEED IN MISSISSIPPI

Rate per acre. The amount of cotton seed which should be used to plant an acre will vary as several conditions vary. When planting is done very early for the location, or if the daily temperatures are low, the rate of seeding should be heavier than when the contrasting conditions exist. When viability of the seed is low, the planting rate should be abnormally high and even if sufficient plants are obtained with poor seed, many will be so weak that low temperatures will cause them to die. Varieties having small seed require less to plant an acre than those having large seed. Delinted seed require less plant an acre, and germination is usually more prompt than is the case with identical seed undelinted.

How differences in seed size affect the rate per acre can be observed from the tables which follow. The first is a tabulation of the average number of seed to the pound for several varieties grown in the valley and hill variety test at Holly Springs and Raymond Branch Stations in 1933. The number per pound varies from about 3,000 for large-seed varieties grown on valley soil to about 4,500 for small-seed varieties grown on hill soil. It will thus be seen that the weight of seed is affected by both variety and soil. It is quite probable that variations in soil moisture are largely responsible for differences produced by differing soils.

The second table can be used in connection with the first to determine the desired rate per acre. For example, if a farmer is using seed with about 3,000 to the pound and wants to plant 12 seed to the foot, he should use about 50 (49.8) pounds to the acre. If, however, the seed are small enough for a pound to contain 4,500, he should use about 33 (33.2) pounds to the acre for the same number of seed to the foot.

The second table assumes the use of rows 3½ feet apart. For 3 foot rows increase the rates in this table about one-seventh.

Number of Seed Per Pound—Seed Produced in Holly Springs and Raymond Variety Tests—1933

Variety	Seed Per Pound	
	Valley	Hill
Acala 4067	3318	3787
Cleveland 54	3569	3877
Cleveland 884	3216	3622
Delfos 531	4031	4461
Delfos 719	3473	3897
D. & P. L. 10	3749	4161
D. & P. L. 11	4149	4496
Deltatype Webber	3141	3531
Farm Relief	3057	3185
Half and Half	4107	4425
Lighting Express	3613	4012
Lone Star 561	3639	3694
Miller 589	3025	3345
Miller 610	3214	3614
Missdel 1	3441	3657
Missdel 3	3272	3658
Missdel 4	4091	4169
Rowden 2088	2988	3309
Stoneville 2	3725	4056
Stoneville 2A	3673	3947
Stoneville 3	4229	4278
Stoneville 4	3429	3651
Stoneville 5	4302	4323
Wilson Type	3776	4112

Pounds Per Acre for Varying Sizes and Numbers Per Foot

No. Seed Per Ft.	Number of Seed Per Pound							
	2500	3000	3500	4000	4500	5000	5500	6000
	Pounds to Plant An Acre							
1	5.0	4.1	3.6	3.1	2.8	2.5	2.3	2.1
2	10.0	8.3	7.1	6.2	5.5	5.0	4.5	4.1
3	14.9	12.4	10.7	9.3	8.3	7.5	6.8	6.2
4	19.9	16.6	14.2	12.4	11.1	10.0	9.1	8.3
5	24.9	20.7	17.8	15.6	13.8	12.4	11.3	10.4
6	29.9	24.9	21.3	18.7	16.6	14.9	13.6	12.4
7	34.8	29.0	24.9	21.8	19.4	17.4	15.8	14.5
8	39.8	33.2	28.4	24.9	22.1	19.9	18.1	16.6
9	44.8	37.3	32.0	28.0	24.9	22.4	20.4	18.7
10	49.8	41.5	35.6	31.1	27.7	24.9	22.6	20.7
11	54.8	45.6	39.1	34.2	30.4	27.4	24.9	22.8
12	59.7	49.8	42.7	37.3	33.2	29.9	27.2	24.9
13	64.7	53.9	46.2	40.4	36.0	32.4	29.4	27.0
14	69.7	58.1	49.8	43.6	38.7	34.8	31.7	29.0
15	74.7	62.2	53.3	46.7	41.5	37.3	33.9	31.1
16	79.7	66.4	56.9	49.8	44.3	39.8	36.2	33.2
17	84.6	70.5	60.5	52.9	47.0	42.3	38.5	35.3
18	89.6	74.7	64.0	56.0	49.8	44.8	40.7	37.3
19	94.6	78.8	67.6	59.1	52.5	47.3	43.0	39.4
20	99.6	83.0	71.1	62.2	55.3	49.8	45.3	41.5

Be sure to plant enough seed. Long blank spaces in the drill do not produce cotton. Even good highly improved seed are relatively cheap compared with other costs of cotton production.

Reference: Mississippi Agricultural Experiment Station Information Sheet 34, "Date and Rate of Planting Cotton," March 1934, State College, Mississippi.

THE EFFECT OF TIME, RATE AND METHOD OF PLANTING COTTON ON GERMINATION

Conducted by: Georgia Agricultural Experiment Station.

Conducted at: Experiment, Georgia.

Purpose: To determine the effect of time and method of planting cotton on germination.

Soil: Sandy clay loam.

Procedure and Conditions: Good seed of Stoneville 2 cotton was used both years. The seeds are counted before planting, planted by hand and plant counts made about a month after planting. Two thousand to three thousand seeds were used for each treatment.

Results: The Effect of Time and Method of Planting Cotton on Germination

Treatment	Germination Per Cent			
	Early March 27	Medium April 16	Late May 26	Average of 3 Dates of Planting
Rate of planting, ½ bushel per acre	28.0	50.1	26.0	34.7
Rate of planting, 1 bushel per acre	38.3	56.8	37.5	44.2
Rate of planting, 1½ bushels per acre	37.3	58.9	39.5	45.2
Planted shallow	43.0	57.3	38.3	45.8
Planted deep	27.5	55.5	28.2	36.8
Planted in hills	37.3	59.1	40.3	45.5
Planted in drills	34.9	51.5	26.3	37.2
Treated with Ceresan	36.0	58.7	33.5	42.7
No treatment	34.0	52.9	35.2	40.5
Average of all treatments	35.1	55.6	33.9	41.4

Reference: Georgia Agricultural Experiment Station Forty-fifth (1932) Report, pages 16 and 17, table 1, Experiment, Georgia.

DEPTH OF PLANTING COTTON SEED

Texas Main Station and Temple Substation cooperating with Bureau Agricultural Engineering, U. S. D. A.

1930—A variable depth attachment was designed and constructed for a riding planter that would plant cotton seed at a variable depth, ranging from 1 to 2½ inches deep. Preliminary trials gave better stands of cotton when this attachment was used than where the seeds were placed at a uniform depth with the equipment.

1931—Studies were continued on the influence of planting cotton seed at varying depths.

1932—Planting cotton seed at varying depths gave slightly better stands than planting the seed at a uniform depth.

1933—The attachment for one-row riding planter, to plant cotton seed at variable depths was changed this year so that a more uniform variation in depth of the seed could be secured. An attachment was also made to give uniform covering of the seed.

Planting the cotton seed at varying depths gave slightly better stands than planting at uniform depths.

1934—Planting the cotton seed at variable depths gave better stands than where the seed was planted at a uniform depth.

1935—Results obtained this year from planting cotton seed at variable and uniform depths did not show any significant differences in the yields.

Reference: Excerps from Annual Reports of the Texas Agricultural Experiment Station for the years 1931, 1932, 1933, 1934, 1935 and 1936.

EFFECT OF ROW WIDTH ON COTTON YIELDS IN ALABAMA

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, and Wiregrass Substation, Alabama.

Period: Two to five years.

Purpose: To study the effect of variations in the width of rows on the yield of cotton.

Soil: Sandy loams.

Procedure and Conditions: In these tests the number of plants per acre was held constant by inverse variations in the width of rows and drill spacings. Each spacing was duplicated under two conditions of fertilization; on the Wiregrass Substation 600 and 300 pounds per acre of a 6-10-4 fertilizer were used; at Auburn 600 pounds of 6-10-4 and no fertilizer were used.

Results: **Effect of Row Widths on Cotton Yields in Alabama**

Width of Rows in Feet	Main Station			Wiregrass Substation		
	Number of plants per Acre	Pounds of Seed Cotton Per Acre (1)		Number of plants per Acre	Pounds of Seed Cotton Per Acre	
		600 Lbs. Per Acre 6-10-4	Un-fertilized		600 Lbs. Per Acre 6-10-4 (2)	300 Lbs. Per Acre 6-10-4 (3)
2½	20,027	1,046	683	16,000	1,262	1,025
3½	20,027	1,055	559	16,000	1,274	1,047
4½	20,027	1,026	511	16,000	1,248	765
5½	20,027	977	472	16,000	1,213	749
6½				16,000	1,141	902

(1) Five-year average
(2) Three-year average
(3) Two-year average

Reference: Alabama Agricultural Experiment Station Circular 76, "Cotton Spacing," pages 7 and 8, table 4, March 1937, Auburn, Alabama.

THE EFFECT OF WIDTH OF ROW ON THE YIELD OF SEED COTTON

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Pee Dee Branch Experiment Station, Florence, South Carolina.

Period: 1929-1935

Purpose: To determine the effect of width of row on the yield of seed cotton.

Procedure and Conditions: Spacing in the drill was the same for all row widths, and fertilizer was applied at the same rate per acre in all cases.

Results: **Yearly and Average Yields of Seed Cotton from Rows of Varying Widths**

Width of Row	Pounds Seed Cotton Per Acre							
	1929	1930	1931	1932	1933	1934	1935	7 Year Average
3 feet	1554	1854	1830	1582	2235	2254	1689	1856.8
3½ feet	1438	1754	1784	1764	2239	2239	1534	1821.7
4 feet	1497	1705	1781	1598	2064	2199	1482	1760.8

Improved cultural practices have been a big factor in maintaining and increasing yields of cotton in this state. The importance of having sufficient plants has been clearly shown by extensive spacing tests at this station over a period of years. For maximum yields the number of plants should range from 15 to 20 thousand plants per acre, depending somewhat on variety of cotton and fertility of the soil. The desired number can be obtained by varying the number of plants in the drill and also the width of rows.

Reference: South Carolina Agricultural Experiment Station Forty-ninth (1936) Annual Report, page 79, Clemson, South Carolina.

IV. SPACING OF COTTON

SPACING TEST WITH COTTON AT HOLLY SPRINGS, MISSISSIPPI

Conducted by: Holly Springs Branch Experiment Station.

Conducted at: Holly Springs, Mississippi.

Period: 1924-1930 and 1933-1937

Purpose: To determine the best spacing for cotton in Mississippi.

Soil: Hill tests—Improved brown loam table soil.
Valley tests—Improved brown loam valley soil.

Procedure and Conditions: In preparing for these tests cotton on all plots was planted at a heavy rate per acre. At thinning time certain plots were left unthinned. An attempt was made to thin one group of plots to three plants per foot, another group to two plants per foot, a third group to one plant per foot, a fourth group to one plant to each eighteen inches, and a fifth to one plant to each two feet. Since in work of this kind it is not possible to obtain any desired spacing exactly, the number of plants actually present at harvest was counted. From these counts the number per foot was computed.

(See table of results, page 26)

EFFECT OF SPACING ON YIELD, SIZE OF BOLLS AND LENGTH AND PERCENTAGE OF LINT IN ALABAMA

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: Six years, 1924-1929

Purpose: To study the effect of spacing on the yield of cotton, size of boll and length and percentage of lint.

Soil: Sandy loam.

Procedure and Conditions: The rows were accurately laid off at the proper distance and seed were planted under a marked wire. The plants were thinned by hand to the desired number per hill after they were well established. As a general rule no measures were taken to control the boll weevil.

Cotton on different plits was spaced 6, 12, 18, 30 and 36 inches apart in 3½ foot rows with one, two, three, and four plants per hill at each drill distance. Each spacing was in duplicate on both fertilized and unfertilized plots.

The fertilized plots were fertilized at the rate of 600 pounds of superphosphate, 300 pounds of nitrate of soda, and 50 pounds of muriate of potash per acre.

(See table of results, page 27)

(Continued from page 25)

Results:

Cotton Spacing Test at Holly Springs, Mississippi

	Yield in Pounds Seed Cotton Per Acre												12 Year Average	
HILL TESTS	1924	1925	1926	1927	1928	1929	1930	1933	1934	1935	1936	1937	Actual Av. Plants Per Foot of Space	Yield Per Acre
Unthinned	1077	1707	1677	1030	1090	1141	729	1525	896	994	881	1170	4.17	1160
Three stalks per 12 inches	1119	1492	1600	1021	983	1221	738	1505	939	926	950	1335	2.37	1152
Two stalks per 12 inches	1090	1569	1538	916	1045	1197	754	1656	1082	1013	1001	1309	1.82	1181
One stalk per 12 inches	1089	1537	1515	905	1102	1096	734	1497	1125	1049	996	1261	1.12	1159
One stalk per 18 inches	1084	1406	1487	823	1080	1293	749	1647	1039	1042	959	1299	.79	1159
One stalk per 24 inches	1114	1106	1471	764	1062	1294	830	1379	1049	942	949	1266	.62	1110
VALLEY TESTS														
Unthinned	2575	1896	1499	1589	995	1757	1432	1484	1410	1081	1043	1901	4.62	1555
Three stalks per 12 inches	1657	1890	1420	1781	1043	1865	1871	1749	1708	1129	1340	2336	2.32	1649
Two stalks per 12 inches	1604	1722	1551	1687	1006	2072	1923	1838	2013	1273	1477	2458	1.69	1719
One stalk per 12 inches	1514	1650	1607	1676	1025	2018	1939	2035	1660	1472	1561	2214	1.00	1698
One stalk per 18 inches	1516	1524	1243	1549	1093	2223	2025	2134	1687	1466	1565	2540	.73	1714
One stalk per 24 inches	1348	1392	1219	1648	1012	2234	1916	2133	1687	1413	1355	2435	.58	1649

Reference: Mississippi Agricultural Experiment Station Bulletin 302, "Holly Springs Branch Experiment Station Report for 1933," pages 4, 5, and 6, December 1933, State College, Mississippi, and Information Sheet 144, "Twelve Years of Cotton Spacing," March 1938, State College, Mississippi.

(Continued from page 25)

Results: Effect of Spacing on Size of Bolls and Length and Percentage of Lint in Alabama

Plot No.	Number of Plants Per Hill	Number Inches Hills Apart In Drill	Number of Plants Per Acre	Number of Bolls Per Pound (1)		Percentage of Lint		Length of Lint 32nds inch (2)		Yield in Lbs. Seed Cotton (1)	
				Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized
1	1	6	24,891	84	88	38	40	26	28	1042	527
2	2	6	49,782	88	95	38	40	27	27	985	464
3	3	6	74,673	93	98	38	40	28	28	909	428
4	4	6	99,564	94	103	38	40	28	27	834	381
5	1	12	12,446	77	83	38	39	25	27	998	493
6	2	12	24,892	88	88	38	40	26	27	1037	516
7	3	12	37,338	88	92	38	40	27	27	994	488
8	4	12	49,784	89	91	38	40	27	28	996	466
9	1	18	8,297	75	79	38	39	27	28	963	487
10	2	18	16,594	78	84	38	39	26	28	1083	518
11	3	18	24,891	83	90	37	38	27	27	1045	478
12	4	18	33,188	83	90	38	40	27	29	1083	485
13	1	24	6,223	72	77	38	39	26	28	931	461
14	2	24	12,446	78	83	38	39	27	28	1059	507
15	3	24	18,669	79	84	38	39	26	29	1082	525
16	4	24	24,892	81	86	38	39	27	28	1039	477
17	1	30	4,978	75	78	38	39	27	28	848	419
18	2	30	9,956	76	81	37	39	27	28	983	454
19	3	30	14,934	79	81	38	39	26	29	1006	499
20	4	30	19,912	81	85	38	38	27	28	1070	480
21	1	36	4,148	73	79	38	39	26	27	832	422
22	2	36	8,296	78	81	38	39	27	28	979	465
23	3	36	12,444	78	81	38	39	27	27	988	467
24	4	36	16,592	78	84	38	39	27	27	992	415

(1) Six-year average
(2) Three-year average

Reference: Alabama Agricultural Experiment Station Circular 76, "Cotting Spacing," pages 2, 3 and 5, tables 1 and 2, March 1937, Auburn, Alabama.

THE EFFECT OF VARYING SPACINGS OF COTTON ON YIELD IN THE MISSISSIPPI DELTA

Conducted by: Delta Branch Experiment Station.

Conducted at: Stoneville, Mississippi.

Period: 1925-1937

Purpose: To determine the effect of varying spacings of cotton on the yield in the Mississippi Delta.

Results: **The Effect of Varying Spacings of Cotton**

	Pounds Seed Cotton Per Acre		Number of Bolls Per Pound	
	12 Yr. Av. 1925-1937	7 Yr. Av. 1931-1937	12 Yr. Av. 1925-1937	7 Yr. Av. 1931-1937
1 plant per hill 11"	1858.9	1560.3	74	77
2 plants per hill 11"	1784.9	1551.0	75	77
Blocked all left 11"	1678.9	1428.1	79	82
1 plant per hill 16½"	1764.7	1588.8	73	75
2 plants per hill 16½"	1836.6	1603.8	74	75
Blocked all left 16½"	1729.2	1494.4	79	82
3 plants per hill 16½"	1809.2	1579.0	75	77

Reference: Mimeograph, "Some Hight Lights on the Work of the Delta Branch Experiment Station, Stoneville, Mississippi," issued in 1938.

EFFECT OF SPACING ON YIELD OF COTTON IN FIVE ALABAMA TESTS

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Main Station at Auburn, Wiregrass, Tennessee Valley and Sand Mountain Substations, and on the Prattville Experiment Field.

Period: Five years, 1930-1934

Purpose: To study the effect of spacing on the yield of cotton.

Soil: Sandy loams at Main Station, Wiregrass Substation and Prattville Field; fine sandy loam on the Sand Mountain Substation and Clay Loam on Tennessee Valley Substation.

Procedure and Conditions: The rows were accurately laid off at the proper distance and seed was planted under a marked wire. The plants were thinned by hand to the desired number per hill after they were well established. As a general rule no measures were taken to control the boll weevil.

The plot treatments were identical at all stations. Each plot received annually 600 pounds of a 6-10-4 fertilizer per acre.

Since the 18-inch drill spacing with two stalks per hill produced the greatest yield in the previous experiment, this spacing was used on the check plots in this experiment. On other plots the hills were spaced 9, 18, and 28 inches apart in 3½ foot rows with one, three and six plants per hill at each drill distance.

Results:

Effect of Spacing on Yield of Cotton in Five Alabama Tests

Plot No.	Spacing		Number	Pounds of Seed Cotton Per Acre---Five-Year Average 1930-34					
	Inches Hills Apart	Number of Plants Per Hill	Plants Per Acre	Main Station	Substations			Prattville	Grand Average of all Crops
					Wiregrass	Tennessee Valley	Sand Mountain		
1	18	2	16,594	1,098	1,404	1,235	1,456	1,004	1,239
2	9	1	16,594	1,109	1,361	1,194	1,467	976	1,221
3	9	3	49,782	1, 043	1,267	1,170	1,326	882	1,138
4	9	6	99,564	1,029	1,162	1,186	1,331	771	1,096
5	18	2	16,594	1,138	1,433	1,298	1,458	983	1,262
6	18	1	8,297	1,084	1,399	1,364	1,413	1,023	1,257
7	18	3	24,891	1,134	1,363	1,375	1,458	961	1,258
8	18	6	39,782	1,083	1,343	1,322	1,416	865	1,144
9	18	2	16,594	1,142	1,419	1,304	1,476	943	1,257
10	27	1	5,532	1,083	1,275	1,226	1,381	992	1,191
11	27	3	16,596	1,157	1,335	1,259	1,386	957	1,219
12	27	6	33,192	1,116	1,313	1,238	1,388	881	1,187
13	18	2	16,594	1,103	1,415	1,336	1,458	978	1,258
Av. of check plots 1, 5, 9 and 13				1,120	1,418	1,293	1,462	977	1,254

Reference: Alabama Agricultural Experiment Station Circular 76, "Cotton Spacing," pages 2, 4, and 6, table 3, March 1937, Auburn, Alabama.

THE EFFECT OF SPACING ON YIELD OF COTTON IN LOUISIANA

Conducted by: Northeast Louisiana Experiment Station.

Conducted at: St. Joseph, Louisiana.

Period: Two years, 1935-1936

Purpose: To determine the effect of spacing on yield of cotton.

Procedure and Conditions: The stalks were spaced at varying distances with one stalk per hill. The rows were 40 inches wide.

Results: Cotton Spacing Test

Spacing	Yield Seed Cotton in Lbs. Per Acre
8 inches	2146
12 inches	2089
16 inches	2101
20 inches	2130
24 inches	1997

Reference: Biennial Report of the Northeast Louisiana Experiment Station 1935-1936, pages 9 and 10, table 13, St. Joseph, Louisiana.

EFFECT OF SPACING ON YIELD OF COTTON AT BATON ROUGE LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge, Louisiana.

Period: Five years 1929-1933.

Purpose: To determine the best spacing for cotton.

Soil: Denham silt loam, designated as bench land and Mississippi river alluvial land soil which is partly Sharkey clay and partly a mixture of sandy alluvium. The bench land soil is moderately productive when well handled but is subject to drought some years. The alluvial land is rather fertile, is rarely affected by drought, and normally produce rank vegetation.

Procedure and Conditions: The plots were fertilized each year with 600 pounds per acre of 5-8-4 fertilizer.

The soil preparation, planting and cultivation were the same as used on our regular crops except that an extra amount of seed was planted to insure enough plants to get the desired spacings. All cotton was planted in rows 4 feet apart.

Four or five row plots with rows 100 feet long were used throughout the experiment. No weights being taken from the 2 outside rows of each plot. Three to eight replications were used, the number depending on the size of the cut of land available. In the majority of cases the number was six or more.

A strain of Delfos was used on the alluvial land throughout the experiment. On the bench land Delta and Pine Land No. 4-8, Stoneville 2 and Dixie-Triumph were used.

The normal annual rainfall at Baton Rouge is 58.25 inches. This is rather evenly distributed throughout the year. During July and August showers occur on approximately half the days. The frequent showers foster rank growth of all kinds and various plant diseases caused by fungi.

Results: Effect of Spacing on Yield of Cotton Per Acre

Spacing	Pounds Seed Cotton Per Acre					5 Year Average
	1929	1930	1931	1932	1933	
			Bench Land			
Unthinned	1265	916		674	1140	999
2 stalks, 10 inches	1283	1174	1160	907	1376	1180
2 stalks, 20 inches	1424	1221	1358	961	1380	1269
2 stalks, 30 inches	1400	1105	1307	1009	1343	1233
1 stalk, 30 inches	1274	1047	1144	985	1268	1144
			Alluvial Land			
Unthinned	1017	1735	1780	634	1645	1362
2 stalks, 10 inches	1237	2077	2248	1053	2501	1823
2 stalks, 20 inches	1376	2098	2194	1063	2442	1835
2 stalks, 30 inches	1205	2062	2093	1128	2444	1786
1 stalk, 30 inches	1279	2160	2056	1159	2427	1816

Effect of Spacing on Vegetative Growth: Experimental results indicate that close spacing did hold down growth in height, both on the bench and alluvial lands. The closest spacing, the unthinned, had plants that averaged 7 to 8 inches lower than the medium-width spacings.

Effect of Spacing on Rate of Blooming: On the alluvial land there was a rather regular decrease in number of blooms every year as the spacing was widened. The average for the five years and during three years of the five, the spacing of two stalks, 10 inches, gave the highest blooming rate. The average on the bench land for the four-year period was also highest for the same spacing, two stalks, 10 inches apart.

There appears to be a close relation between the rate of blooming and the rate of shedding. If the blooming rate is high, it is reasonable to expect a high rate of shedding because there are consequently more forms there to be shed and the plants are subjected to greater stress to support the larger number of forms.

Effect of Spacing on Earliness: Experimental results show that in the bench-land test, the unthinned plots gave the highest percentage of the crop the first picking rather consistently. On the alluvial land, the highest percentage was obtained consistently from the second closest spacing.

Effect of Spacing on Shedding: During the four years this test was run, almost without exception, there was a gradual decrease in rate of shedding as the spacing increased.

Effect of Spacing on Boll Weights: Results show that the bolls become larger very regularly and consistently as the spacing is widened, both on the bench land and on the alluvial land.

Effect of Spacing on Boll Rot: Counts made for three and four year periods show that the number of rotten bolls becomes fewer as the spacing is decreased, but the difference is hardly so great as one would expect.

Effect of Spacing on Lint Percentage: Samples of seed cotton from the spacing plots were ginned on different years to determine lint percentage. There seemed to be no consistent difference between plots. This was to be expected probably because there does not appear to be any definite cause for difference.

Effect of Spacing on Length of Staple: Rather extensive measurements of the staple from the various spacings were made in 1931, 1932 and 1933.

The lengths obtained in 1931 showed the fibers from the unthinned plots to be significantly shorter than the fibers from the spaced plots and there is a regular increase in length as the spacing is widened. This increase was very regular and consistent in both bench land and alluvial-land plots. In 1932, the lint from the bench-land plots showed a difference between the spaced and unspaced plots similar to that of 1931, except that the spread was not so wide. Within the spaced plots, slight differences appeared for the different widths of spacing. In the alluvial-land plots in 1932 there seemed to be no consistent difference in lint length between the unthinned and the spaced plots, or between the plots with the various spacings used. In 1933 no consistent difference appeared between the unthinned and spaced plots in either set of experiments.

Reference: Louisiana Agricultural Experiment Station Bulletin 246, "Cotton Spacing in Southern Louisiana in Relation to Certain Plant Characters," pages 3, 18, 19, 21, 23, 24, 25, 26, 27, 28, and 30, table 21, March 1934, Baton Rouge, Louisiana.

THE EFFECT OF NUMBER OF STALKS PER HILL ON YIELD OF COTTON IN LOUISIANA

Conducted by: Northeast Louisiana Experiment Station.

Conducted at: St. Joseph, Louisiana.

Period: Two years, 1935-1936

Puropose: To determine effect of varying stalks per hill on yield of cotton.

Procedure and Conditions: The hills of cotton were 12 inches apart, with from one to five stalks per hill. The rows were 40 inches wide.

Results: Cotton Stalks Per Hill Test

Stalks Per Hill	Yield Seed Cotton Pounds Per Acre
1	2234
2	2374
3	2315
4	2305
5	2281

Reference: Biennial Report of the Northeast Louisiana Experiment Station 1935-1936, page 9 and 10, table 14, St. Joseph, Louisiana.

EFFECT OF NUMBER OF PLANTS IN CHECKED COTTON ON YIELD IN MISSISSIPPI DELTA

Conducted by: Delta Branch Experiment Station.

Conducted at: Stoneville, Mississippi.

Period: 1923-1937

Purpose: To determine the effect of plants in checked cotton on yield in the Mississippi Delta.

Results: Yields from Cotton Checked in 40" Rows with Various Numbers of Stalks Per Hill

Number Stalks Per Hill	Pounds of Seed Cotton Per Acre			
	14 Year Average 1923-1937		1937	
	Yield	Increase	Yield	Increase
2 plants per hill	1416.7	-11.9	1138.4	- 90.1
3 plants per hill (check)	1428.6		1228.5	
4 plants per hill	1494.0	65.4	1262.4	33.9
5 plants per hill	1476.5	47.9	1332.2	103.7
6 plants per hill	1447.3	18.7	1234.0	5.5
7 plants per hill	1428.3	- .3	1216.9	- 11.6
All plants left	1377.5	-51.1	1250.8	22.3

Reference: Mimeograph "Some High Lights on the Work of the Delta Branch Experiment Station, Stoneville, Mississippi," issued in 1938.

THE EFFECT OF EARLY AND LATE THINNING OF COTTON UPON THE YIELD

Conducted by: Georgia Agricultural Experiment Station.

Conducted at: Experiment Station Farm near Griffin, Georgia.

Period: 1921-1922

Purpose: To determine the effect of early and late thinning of cotton on the yield.

Soil: Cecil sandy loam.

Procedure and Conditions: The test was run on the same land year after year. The plots were at least 1/20 acre in size and repeated at least 3 times.

In a spacing experiment cotton was thinned with a hoe, care being taken to leave a few more plants than the required number. The surplus plants were then removed by hand, taking these from hills of three or more stalks. No attempt was made to space stalks exactly 4, 8 or 12 inches in the row. However, wide skips were avoided, and no more than three plants per hill were allowed. As a rule in 8 inch spacing, 2 plants per hill 16 inches apart was considered a satisfactory equivalent, or when it could not be avoided three plants per hill were left to cover a 24 inch skip.

Results: Comparison of Early and Late Thinning of Cotton

Treatment		Seed Cotton in Pounds Per Acre			
		1921	1922	Average	Rank
Not thinned		142	933	537	
Thinned to 4 inches:	Early	205	917	561	2
	Late	142	667	404	5
Difference		63	250	157	
Thinned to 8 inches:	Early	258	920	589	1
	Late	138	657	397	6
Difference		120	263	192	
Thinned to 12 inches:	Early	235	840	537	3
	Late	100	573	336	7
Difference		135	267	201	
Thinned to 16 inches:	Early	167	900	533	4
	Late	143	460	301	8
Difference		24	440	232	
Thinned to 20 inches:	Early	134	867		
	Late		473		
Difference			394		

The seasons during which these experiments were run have been the worst in the history of the state. Boll weevils have decreased the yields every year, but in 1921 and 1922 they were especially bad.

From 1914 through 1918 an experiment with delayed thinning of cotton was conducted at this station. There were no boll weevils on the cotton during that period. The loss from delayed thinning in that experiment averaged 192 pounds of seed cotton per acre. The results therefore agree with those given in the above table which were conducted under very severe boll weevil infestation.

Reference: Georgia Experiment Station Bulletin 152, "Cotton Fertilizers and Cultural Methods," pages 1, 29, and 30, table 21, April 1929, Experiment, Georgia.

V. THE CULTIVATION OF COTTON

THE EFFECT OF CULTIVATION ON YIELD OF COTTON ON CECIL SANDY SOIL

Conducted by: Georgia Agricultural Experiment Station.

Conducted at :Griffin, Georgia.

Period: 1925-1928

Purpose: To determine the effect of cultivation on yield of cotton.

Soil: Cecil sandy clay loam.

Procedure and Conditions: The "no cultivated" plots were scraped as lightly as possible with a hoe, leaving the ground bare and hard throughout the summer. The cultivated plots were plowed with a scooter and scraped as often as necessary.

Only in 1928 did the cultivated plots out-yield the no cultivation plots, and here the difference is small. Even in the extremely dry year of 1925, when a good dust mulch was maintained on the cultivated plot, the "no cultivation" plot gave the best yield. Apparently the dust mulch did not conserve moisture. In 1927 the injury due to cultivation amounted to 269 pounds of seed cotton per acre. In this year rainy weather prevented the cultivation of the crop for three weeks so that weeds got a good start. Plowing deep enough to kill the weeds probably injured the cotton.

The land in these experiments was plowed, the rows run out, the fertilizer applied, and bedded on at the same preparation.

Results: **Cultivation Test with Cotton**

	Seed Cotton in Lbs. Per Acre				
	1925	1926	1927	1928	Average
1. No cultivation, weeds removed with a hoe	804	1681	1110	800	1099
2. Cultivated	731	1657	841	818	1012
3. Difference---1 over 2	73	24	269	-18	87

Reference: Georgia Agricultural Experiment Station Bulletin 152, page 29, table 20, "Cotton Fertilizers and Cultural Methods," April 1929, Experiment, Georgia, and correspondence with R. P. Bledsoe, Agronomist, Georgia Experiment Station, Department of Agronomy, Experiment, Georgia.

Suggestive: Could the farmer depend on the hoe as a practical method of controlling weeds and grass? What factors should determine the number of cultivations given? What factors should be determined the depth of cultivation?

FREQUENT AND INFREQUENT CULTIVATION OF COTTON AT BEEVILLE, TEXAS

Conducted by: Texas Agricultural Experiment Substation No. 1.

Conducted at: Beeville, Texas.

Period: 1913 and 1914.

Purpose: To determine the effects of frequent and infrequent cultivation on cotton.

Land History: The experiment plots have been included in a regular cropping system, which provide that the same crop precede a given series on plots from year to year, thus affording uniform moisture and soil conditions. Guard rows have been used in all cases.

Soil: Victoria series.

Procedure and Conditions: The cotton used in all cases was Mebane grown on the substation. All plots had similar treatment in every manner except for the difference in number of cultivations. The plots cultivated frequently received twice as many cultivations as plots cultivated infrequently. The plots cultivated infrequently received a sufficient amount of cultivation to keep down weeds and show no great loss of water by evaporation.

Substation No. 1 of the Texas Agricultural Experiment Station is located 5.7 miles northeast of Beeville, Bee County, Texas, with a latitude of 28 degrees and a longitude of 97 degrees. It is 240 feet above the sea-level.

The five-year (1910-1914) average rainfall by months is:

Jan.— .78	May—5.13	Sept.—4.29
Feb.—1.93	June—2.59	Oct.—3.91
Mar.—2.29	July— .49	Nov.—2.37
Apr.—3.66	Aug.—2.65	Dec.—1.89

Average yearly (1910-1914) rainfall 31.96 inches

Results: **Frequent and Infrequent Cultivation of Cotton**

Kind of Cultivation	Yield of Seed Cotton in Lbs. Per Acre		
	1913	1914	Average
Frequent	792.5	574.4	684.4
Infrequent	792.5	571.0	681.7

Reference: Texas Agricultural Experiment Station Bulletin 214 pages 5 and 9, table 5, "Progress Report, Substation No 1," April 1917, Beeville, Texas.

Suggestive: Did the extra cultivation increase the yield enough to pay for extra labor?

EFFECT OF FREQUENCY OF CULTIVATION ON YIELD OF COTTON

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Northeast Louisiana Experiment Station, St. Joseph, Louisiana.

Period: One year, 1930.

Purpose: To determine the effect of frequent cultivation on yield of cotton.

Soil: Sarpy fine sandy loam of rather good productive character, well drained, and had been in cultivation 90 to 100 years.

Procedure and Conditions:

Planted: April 28.

Fertilizer: Two hundred pounds of nitrate of soda in split applications.

Cultivation: The cotton was given a thorough weekly plowing, using a two-mule one row cultivator. The hoe work was about the same as given to any other cotton, chopping and two hoeings later. When the cotton was laid-by on August 21 no other work with cultivator or hoes was given.

Results: **Effect of Frequency of Cultivation on Yield**

	Yield Seed Cotton Per Acre
Cultivated weekly to June 17, every other week to Aug. 21	1654
Cultivated weekly to Aug. 21	1689

Reference: North Louisiana Agricultural Experiment Station Biennial Report, (1930-31) pages 3 and 6, St. Joseph, Louisiana and letter from C. B. Haddon, Superintendent, Northeast Louisiana Experiment Station, dated December 27, 1937.

Suggestive: Did the 45 pounds increase of seed cotton in 1930 of the weekly cultivated over the every other week after June 17 pay for the extra cultivations?

EFFECT OF EARLY AND LATE "LAYING-BY" ON YIELD OF COTTON

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Northeast Louisiana Experiment Station, St. Joseph, Louisiana.

Period: One year, 1930.

Purpose: To determine the effect of continuing cultivation till late in the season.

Soil: Sarpy fine sandy loam of rather good productive character, well drained, and had been in cultivation 90 to 100 years.

Procedure and Conditions:

Planted: April 28.

Fertilizer: Two hundred pounds of nitrate of soda in split applications.

Cultivation: The cotton was given a thorough weekly plowing, using a two-mule one row cultivator. The hoe work was about the same as given to any other cotton, chopping and two hoeings later. When the cotton was laid-by no other work, with cultivator or hoes was given.

In 1931 the test was repeated but rains during mid-summer prevented all late cultivations, it being too wet to do any cultivation after July 1 until so late that we decided that more harm would result than good from stirring the soil. In 1932 the results of the test bore out, to a certain extent, the results of the work in 1930, though the increase from late cultivations was not quite so great. No work had been done on this project since 1932.

Results: **Effect of Continued Cultivation on Yield**

	Yield of Seed Cotton Per Acre
Laid-by June 24	1802
Laid-by August 21	2032

Reference: North Louisiana Agricultural Experiment Station Biennial Report, (1930-31) pages 3 and 6, St. Joseph, Louisiana and letter from C. B. Haddon, Superintendent, Northeast Louisiana Experiment Station, dated December 27, 1937.

Suggestive: How much did the late cultivation increase the yield per acre over the early laid-by plots in this test in 1930? Was the increase in yield as much in 1932 and 1930?

EFFECT OF CROSS-ROW CULTIVATION FOLLOWED BY SHALLOW SWEEP CULTIVATION ON YIELD OF SEED COTTON ON RED BAY FINE SANDY LOAM

Conducted by: U. S. Bureau of Agricultural Engineering and Alabama Agricultural Experiment station.

Conducted at: Prattville, Alabama.

Period: 1932-1936.

Purpose: To determine effect of cross row cultivation on yield of seed cotton on Red Bay Fine Sandy Loam.

Soil: Red Bay Fine Sandy Loam. The findings set forth will have more or less direct application to several million acres of the costal plains soil that have textural and structural properties similar to this Red Bay fine sandy loam though classified under other names.

Procedure and Conditions: The Bureau's variable depth system of cotton planting was used on all tillage experimental plots and an ample stand was obtained with the first planting on each plot each year. The Bureau's one-operation method of cotton planting consists in cutting the seed bed to the desired height with a sweep shaped to give the bed a slight crown and then planting the seed with the variable-depth planter.

In the early stages of cotton growth cross cultivation operations were used as shown in the following table. The principal feature of this table is that cross row cultivation with the rotary hoe and weeder can be performed on Red Bay fine sandy loam soil several times without destroying the stand. The practical value of these low cost machine operations is that they make it possible to lengthen the normal chopping period. The cross cultivation operations as studied will not be satisfactory on land infested with Johnson grass, nut grass, or weeds coming from large seeds.

Results: Effect of Cross-Row Cultivation Followed by Shallow Sweep Cultivation on Yield of Seed Cotton

Cross Cultivation	Average Yield of Seed Cotton Per Acre in Pounds (1)	Average Time for Chopping Per Acre
2 cultivations with drag harrow	1,295	9.2
3 cultivations with drag harrow	1,272	9.0
5 cultivations with drag harrow	1,268	8.2
2 cultivations with rotary hoe	1,215	9.5
3 cultivations with rotary hoe	1,347	9.5
5 cultivations with rotary hoe	1,311	8.6
2 cultivations with weeder	1,331	9.6
3 cultivations with weeder	1,316	9.6
5 cultivations with weeder	1,340	7.6
1 cross blocked	1,207	9.7
1 hoed during test period (check)	1,337	8.2

(1) Weighted for soil variability by checks.

Reference: Mimeograph No. 3051, "Part Played by Tillage Equipment and Tillage Methods on Yield of Cotton on Red Bay Fine Sandy Loam, pages 3, 6, and 11, table 3, Statement by John W. Randolph, Agricultural Engineer, U. S. Bureau of Agricultural Engineering, before the Farm Equipment Institute, Chicago, Illinois, December 2, 1937.

Suggestive: Which of the plots had a comparable production with the plot (check) that was hoed during the test?

EFFECT OF HIGH AND LOW BED CULTURE ON YIELD OF COTTON

Conducted by: Louisiana Agricultural Experiment Station

Conducted at: Baton Rouge, Louisiana.

Period: 1931-1936

Purpose: To determine the relative effect of high and low bed cultivation for cotton.

Soil: Bench land (1931, 1932, 1935 and 1936).
Alluvial land (1933-1936).

Results: **High and Low Bed Cotton Culture**

Location	Year	Height of Plants		Yields Seed Cotton Lbs.	
		High Beds	Low Beds	High Beds	Low Beds
Bench land	1931	38.4	34.9	1536	1623
Bench land	1932	46.3	49.3	1016	1104
Bench land	1935			1804	1629
Bench land	1936	33.2	32.7	1172	1436
Alluvial land	1933	47.4	46.3	2677	2548
Alluvial land	1934	54.9	57.1	1250	1137
Alluvial land	1935	56.1	58.4	1777	1515
Alluvial land	1936	32.1	33.5	2020	1920

Reference: Louisiana Agricultural Experiment Station Bulletin 283, page 15, table 8, "Crops and Soils Information," March 1937, Baton Rouge, Louisiana.

Suggestive: Which produced the highest yields of seed cotton the high beds or low beds on bench land? On alluvial land? What factors might influence the yields of crops planted on high or low beds?

EFFECT OF ROOT PRUNING BY DEEP PLOWING ON THE GROWTH AND PRODUCTION OF COTTON PLANTS

Conducted by: Louisiana Agricultural Experiment Station

Conducted at: Baton Rouge, Louisiana.

Period: 1929-1935.

Purpose: To determine whether or not it was possible and practical to hold down the excess vegetative growth by root pruning in deep plowing. On the richer lands of South Louisiana, there is a tendency for cotton plants to make such rank growth that they do not fruit well and there is much boll rot.

Soil: Bench land (Lintonia silt loam) in 1929 and 1931
Alluvial land (mostly Sharkey clay) in 1932-1935

Procedure and Conditions: Deep plowing near the plants with small shovel plows; medium deep plowing with large shovels on a double shovel; and shallow cultivation with buzzard wing sweeps. The yields given in the table are plot yields.

The size of the plots varied some different years but was usually in one-twelfth acre plots for each treatment. Four row plots were grown but only the two middle rows were used for weights. Four replications were used where possible.

Root Pruning Experiment

Treatment	1929		1931		1932		1933		1934		1935		6 Yr. Av.	
	Plant Height	Cotton Yield	Plant Height	Cotton Yield	Plant Height	Cotton Yield	Plant Height	Cotton Yield	Plant Height	Cotton Yield	Plant Height	Cotton Yield	Plant Height	Cotton Yield
	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds
Deep plowing	53.1	84.5	29.5	166.4	41.6	133.0	43.3	49.6	54.2	51.5	52.4	185.0	45.8	111.7
Medium plowing	55.8	80.2	30.5	184.6	42.8	136.8	46.7	49.9	57.6	52.0	50.7	193.2	47.3	116.1
Shallow plowing	53.8	82.8	32.2	178.2	44.7	136.5	47.9	51.0	57.7	48.1	51.3	185.3	47.6	113.6

Reference: Louisiana Agricultural Experiment Station Bulletin 283, pages 15, 16, table 9, "Crops and Soils Information," March 1937, Baton Rouge, Louisiana, and letter from Dr. H. B. Brown Agronomist, Louisiana Agricultural Experiment Station, Baton Rouge, Louisiana, dated January 3, 1938.

Suggestive: Did the depth of plowing influence the height of the plants? Did the depth of plowing incluence the yield of the plots in seed cotton?

EFFECT OF SEVERAL METHODS OF ROW CULTIVATION ON YIELD OF COTTON

Conducted by: U. S. Bureau of Agricultural Engineering and Alabama Agricultural Experiment Station.

Conducted at: Prattville, Alabama.

Period: 1932-1936.

Soil: Red Bay Fine Sandy Loam. The findings set forth will have more or less direct application to several million acres of the Coastal plains soils that have textural and structural properties similar to this Red Bay fine sandy loam though classified under other names.

Procedure and Conditions: The Bureau's variable depth system of cotton planting was used on all tillage experimental plots and an ample stand was obtained with the first planting on each plot each year. The Bureau's one-operation method of cotton planting consists in cutting the seed-bed to the desired height with a sweep shaped to give the bed a slight crown and then planting the seed with the variable depth planter.

Results: **Effects of Methods of Row Cultivation on Yield of Cotton**

Cultivations	Average Hours of		5 Year Average Yield of Seed Cotton Per Acre (1)
	Machine Work	Hoe Work	
Hoe only		62.8	1,195
3 shallow---sweeps	5.8	14.2	1,246
6 shallow---sweeps (Check)	11.3	12.1	1,224
12 shallow---sweeps	21.2	12.0	1,226
6 deep---shovels	14.4	12.3	1,181
3 deep and 3 shallow	12.8	12.7	1,232
3 shallow and 3 deep	13.1	12.6	1,193
6 turn plow and middle buster	(2)	17.9	1,139

(1) Weighted for soil variability by checks.
(2) Was not given in source of information.

Reference: Mimeograph No. 3051, "Parts Played by Tillage Equipment and Tillage Methods on Yield of Cotton on Red Bay Fine Sandy Loam," pages 3, 7, and 11, table 4, Statement by John W. Randolph, Agricultural Engineer, U. S. Bureau of Agricultural Engineering, before the Farm Equipment Institute, Chicago, Illinois, December 2, 1937.

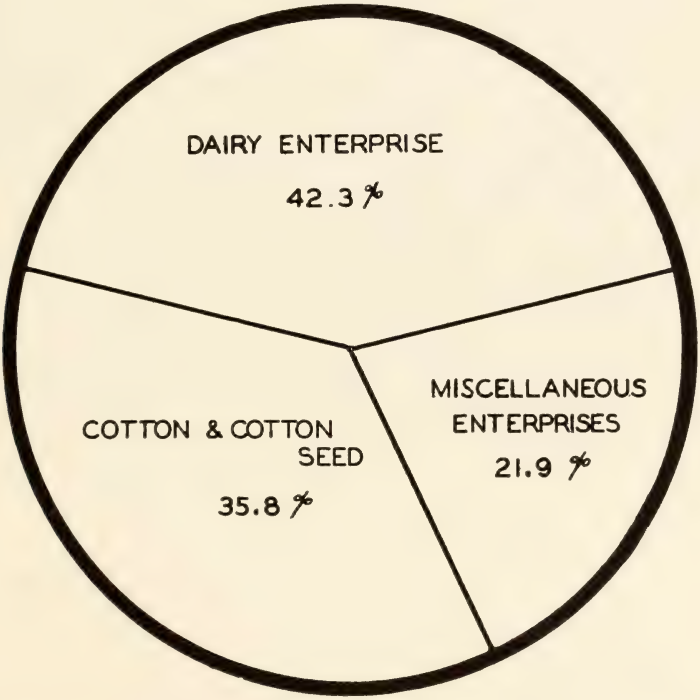
Suggestive: What methods of cultivation produced most seed cotton per acre? Could Johnson grass, nut grass or large weeds be controlled by infrequent shallow cultivations with sweeps? What number of cultivations gave the greatest yield per acre? What was the effect on yield when the number of cultivations were increased?

Bulletin No. 324 October, 1938

An Economic Study of Dairy Farming in Oktibbeha and Lowndes Counties, Mississippi, 1936-1937

By

MARVIN GUIN
Associate Agricultural Economist



The average relative contribution of specified farm enterprises to the total cash receipts on 56 dairy farms in Oktibbeha and Lowndes Counties, Mississippi, 1936-1937.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
Clarence Dorman, Acting Director
STATE COLLEGE, MISS.

SUMMARY AND CONCLUSIONS

Oktibbeha and Lowndes counties, especially those portions within the northeast prairie area, are well suited to dairy production. Pasture and hay production can be made profitable. Good grade cows kept for the production of milk and cream for the Borden Plant and the Cooperative Creamery represented the most important type of animal enterprise. The Borden Plant at Starkville, and the Cooperative Creamery at State College and the Kraft Phoenix Cheese Plant, the Columbus Ice Cream and Creamery Company, and the Cooperative Dairies, Inc. at Columbus provide good and constant markets for milk and cream. Cotton and cottonseed ranked next to dairying in cash receipts on the farms studied.

It is important that farmers dispense with wasteful methods of production, and that they replace unprofitable cows with good ones. It appears that by far the most important consideration for this area is an increase of the average production per cow. There are some herds in this area that are fair in this respect, none are exceptional, and the average of 101.6 pounds of butterfat sold per cow for all is very low. On the whole, production per cow is the weakest phase of farm management in these two counties. A number of factors are possibly responsible for this, such as a lack of close personal supervision, failure to provide home grown feeds, poor feeding and housing, failure to improve pastures, inferior breeding and culling practices, diseases in which Bangs ranks first, cows dry for long periods, especially in the winter season, and lack of proper sanitation: in other words, a failure to "weed, breed, and feed" to best advantage.

The lack of a well planned roughage production program is a real weakness in the organization of most of the dairy farms, and represents a considerable handicap to individual operators. Not only is there an insufficiency of home grown feeds, but from 75 to 85 per cent of the roughage is low in quality. Harvesting is usually delayed until the hay is over mature, and it is over exposed in the process of curing. The effects of the quality of roughage on milk production was often hidden on the farm by the variation in concentrates fed. Good feed should be fed liberally.

The economic size and efficiency of the farm is an important factor. Some dairymen in this area could, by the use of closer personal supervision, better utilize labor and management by increasing the size of the herd. Many producers, considering the small amount of attention given to dairying, could make more money by culling out the poorer half of their herds. Probably the most desirable business unit would be one a little larger than the average. An efficient unit might consist of from 20 to 35 cows combined with cotton and such other enterprises as can be fitted into the organization without serious conflict with the dairy. New emphasis may be placed on dairy production in this area, since the soil conservation program emphasizes grass and grazing. The unfavorable cotton situation is causing many counties of the South to look more than ever to livestock as an agrarian salvation.

With reasonable price conditions and the proper number of good cows, it should be profitable by skillful management to make a go of dairying in this section. There are some good dairy farmers in Oktibbeha and Lowndes counties, and their worthwhile practices should be emulated by many others in contributing to a more sound and permanent agriculture.

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An Economic Study of Dairy Farming in Oktibbeha and Lowndes Counties, Mississippi, 1936-1937

By

MARVIN GUIN

Associate Agricultural Economist

INTRODUCTION

Among the relatively new enterprises to which the farmers of Mississippi have turned in recent years, dairying is of major importance. This is particularly true of Oktibbeha and Lowndes counties, where natural conditions for dairying are excellent and where the industry is well established as a dependable source of farm income. Since statistics taken recently show a tendency toward increased dairy farming in many portions of Mississippi, an economic survey was made of dairy production and marketing in these two counties, and the results of this study are presented here.

OBJECTIVES

The major purposes of this study are:

(1) To ascertain the farm management practices, expenses and profits of dairy farms of different sizes operating under varying conditions, and from these data to draw conclusions as to the most efficient size of dairy farms and the most efficient production practices.

(2) To learn the marketing practices, services and cost of services used in marketing dairy products; the quality and quantity of products sold, and to point out any improvements which may be made in the marketing facilities and services.

MATERIALS AND METHODS

Location and Description of the Area Studied

Dairying really began in Oktibbeha County in 1860 when Col. W. B. Montgomery, then a recent graduate of Princeton and later a member of the first Board of Trustees of Mississippi State (then A. and M.) College, advocated and practiced diversification, the growth of forage crops and dairy cattle. He placed a large number of pure bred dairy bulls in the county, securing them from Tennessee and New York. In about 1868 he imported to Starkville the first Jersey cow that was brought from the island of Jersey to the South.

Mississippi State College started a creamery in 1885, until which time a number of dairymen made and shipped their own products. The creamery was not successful and did not continue to operate; however, the dairymen continued to produce some farm butter and the dairy industry in the area continued to grow.

The Mississippi State College organized the present Cooperative Creamery in 1912, which handled 184,027 pounds of butter in 1913 as compared with 638,902 pounds of butter handled in 1937. The Borden Company established

April 1, 1926 at Starkville received 15,644,428 pounds of milk valued at $400,526 for the first nine months of operation, as compared with 33,394,243 pounds of milk received in 1937.

Lowndes County has two modern well-equipped creameries, one Kraft Phoenix Cheese Plant, and two milk and ice cream plants, all of which are located at Columbus.

Oktibbeha County was one of the first to become accredited tick free, and during the year 1927 state and federal veterinarians gave the tuberculin test to the majority of herds in the county. Both Oktibbeha and Lowndes counties are now accredited and free of tuberculosis among cattle.

The area in which this study was made includes those parts of Oktibbeha and Lowndes counties where the soil type is best suited to grazing crops, the largest per cent of the dairy farms being located on the black prairie land. This section contains some of the best grazing land in Mississippi, since a wide variety of grasses and clovers are well adapted to the region. Fig. 1 shows the area covered in this survey.

Oktibbeha County, often referred to as "the county that cows built", is located in the northeast prairie area of Mississippi. Due to its elevation, which is 362 feet above sea level at Starkville, and its many natural streams, this county is well drained. The topography is gently rolling with frequent outcrops of limestone. There are three predominating soils in the county: the black prairie and post oak lands in the eastern part of the county, and the flatwoods in the western part.

The normal rainfall of 52.82 inches is well distributed throughout the year, with the lowest monthly average precipitation in the fall season. The long growing season and abundant rainfall are natural advantages for dairy farming. The average frost dates are November 6 and March 26, and the winter months are usually mild, making expensive housing unnecessary.

Lowndes County, which adjoins Oktibbeha on the east, has two predominating soils: the black prairie land on the west side of the Tombigbee River and sandy loam on the east side of the river. The black prairie land in this county is the type to which dairying is best adapted.

Climatic factors in Lowndes County are also suited to dairy farming. The elevation at Columbus is 191 feet above sea level; the yearly average temperature for the years 1929-1933 was 66° F; the rainfall was 52 inches; and the growing season was 208 days*.

During the 1936 crop year, rainfall was generally light in the two counties studied, and feed crops and pastures were cut short, which accounts in part for the low amount of roughage fed during the winter and spring seasons. Rain was plentiful during the spring and summer of 1937, and pastures were good.

Each county is served by three railroads and a number of truck lines for the transportation of farm products. The Mississippi Power Company, an associate of the Alabama Power Company, serves this section with power for industry and rural farm lines; also the Rural Electrification Association power transmission lines carrying TVA power furnish cheap power rates for industrial and farm use.

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*R. T. Lindley, Mississippi Section Climatalogical Data, Vol. XIII, No. 13, U. S. Department of Agriculture, Weather Bureau, 1936.

Most of the farms in the area studied are located on gravel or dirt roads, while a railway and a highway serve each of the communities in which the milk plants are located.

Methods Used

The following discussion of the factors which affect Mississippi farm incomes is based on fifty-six farm business records covering the year which ended July 31, 1937. The data were secured by the survey method.

The data on milk and cream sales and purchases of feed and supplies were copied from records of the Cooperative Creamery, the Borden Company, Swift and Company, and the Kraft Phoenix Cheese Company. Records were obtained largely from farmers having five or more dairy cows on all types of dairy farms, and who had sold milk or cream continuously over the preceding five-year period to the dairy plants, of which they were patrons at the time.* The farm records included inventories, expenses, receipts, practices, and the farm organization with respect to crops and livestock. The sales of dairy products were tabulated by months. The pasture utilization was determined with respect to kind of plants, number of cows on pasture and dates pastured.

Through the assistance of the county agents and others familiar with local conditions, an impartial selection of farmers' names was made from the list of patrons at the several milk plants in the two counties, Oktibbeha and Lowndes. The object was to get a representative cross-section of the dairy enterprise, avoiding too large a proportion of either the better or poorer farms, herds, or farmers. The dairy farms included in this study are believed to be fairly representative of their communities, and the relationships disclosed in the data may be accepted as approximate expressions of similar relationships on other Mississippi dairy farms.

The cost data were obtained from the dairymen in personal interviews and were based largely on careful detailed estimates made by the dairymen, while books and records were used whenever available. Through the cooperation of the milk buying companies, accurate accounts of the amounts and prices of wholesale milk and cream delivered to them by each farmer and other information on receipts and expenditures were made available. This eliminated some chances of error that would probably have occurred through failure to find the farmers' pay slips. It also saved time of the farmer and the enumerator in recording the details of the business.

Definition of Terms

Acres Operated—The total amount of farm land operated as a unit.

Farm Capital—The value of the real estate, livestock, equipment, feed, and other supplies.

Animal Unit—A mature horse or cow or the equivalent in other livestock based upon the amount of feed eaten and manure produced.

Farm Receipts—The receipts from crops, livestock, crops on hand for sale at end of the year, livestock products sold, increase in inventory of livestock and in real estate and equipment, and miscellaneous receipts from man and horse labor and rent.

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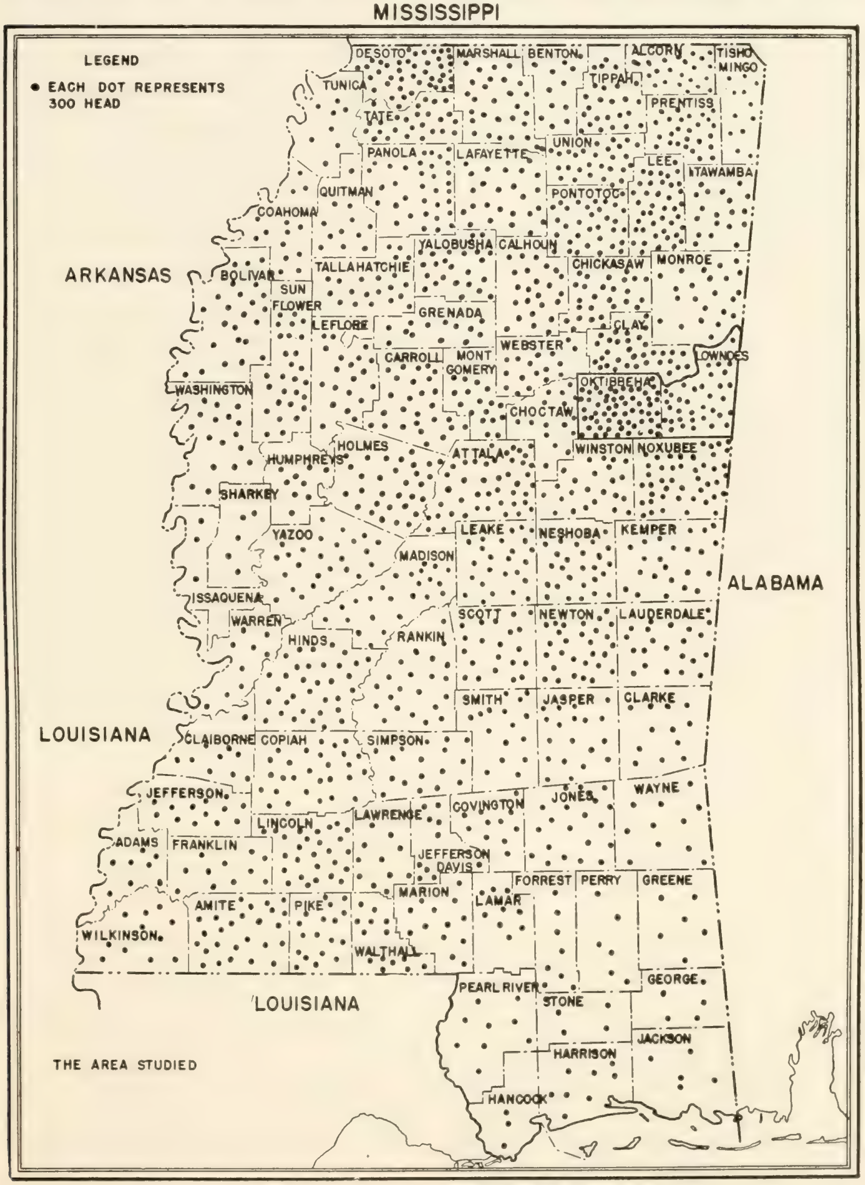
*Since each farm had an average of one tenant and family, the definition of a farm in this study differs from the United States Census definition.

Farm Expenses—Farm expenses actually incurred such as for fertilizer, ginning, repairs, decrease in feed and livestock inventories, and in equipment, and the value of unpaid family labor.

Farm Income—The difference between the farm receipts and the farm expenses. It is the income from the farm for the operator's labor and the use of the farm capital. It does not include the family living from the farm.

Labor Income—The farm income less four per cent on the average investment. It is what a farmer receives for his year's work in addition to interest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FORREST
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GREENE
AMITE
PIKE
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LAMAR
WILKINSON
WALTHALL
GEORGE
PEARL RIVER
STONE
JACKSON
HARRISON
HANCOCK

Figure 1. Number of cows and heifers milked in Mississippi, 1934.

on his investment, all farm expenses, having a house to live in and farm products to use in the home.

Profits—The return from a farm business above all costs—costs include all expenses,* value of operator's labor, and an interest charge for use of the farm capital. The value of products produced by the farm and used by

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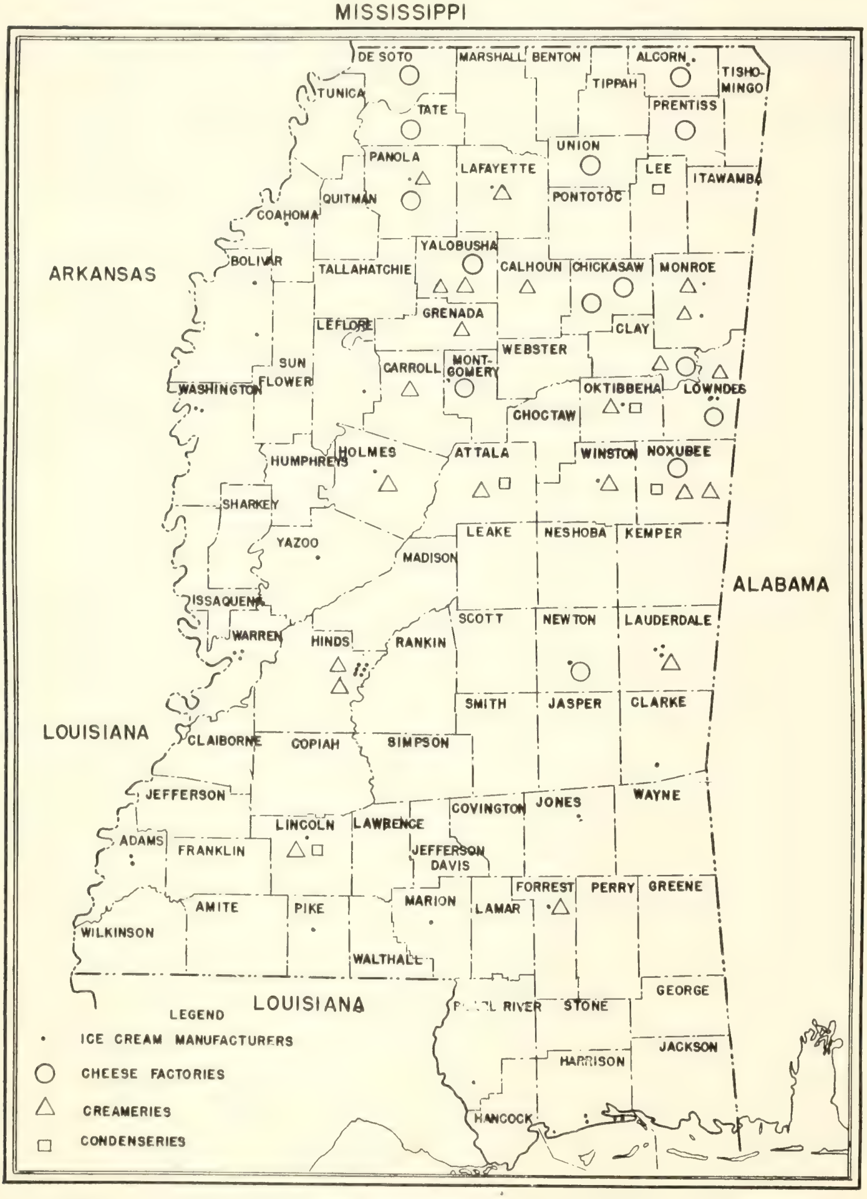
*The family labor other than the operator is included in the cash expenses in this study.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WALTHALL
GEORGE
PEARL RIVER
STONE
JACKSON
HARRISON
HANCOCK
LEGEND
• ICE CREAM MANUFACTURERS
○ CHEESE FACTORIES
△ CREAMERIES
□ CONDENSERIES

Figure 2. Location of ice cream manufacturers, cheese factories, creameries and condenseries in Mississippi in 1938.

the operator's family is included in the receipts. The value of the house rent is not included in the receipts.

Present Place of Dairying

Some of the important factors which determine the location and extent of dairying are the size of local markets, weather conditions, and yield of pastures and feed crops.

The distribution of cows in Mississippi by counties, as reported in the United States Census, is shown in Figure 1. Although cows are rather evenly distributed over the state, there are a few more in the northeastern part of the state in the lime belt section where the counties studied are located. Oktibbeha, Noxubee, Desoto, and Lee are the leading counties in number of dairy cows and heifers milked.

In 1938 there were twenty-two creameries in Mississippi located largely in the east central and northern part of the state. (See Fig. 2). The creameries manufactured 6,050,180 pounds of butter. Five milk plants manufactured 1,343,962 pounds of powdered milk, and twenty-two milk plants distributed 32,184,831 pounds of fluid milk in 1936. There are two cooperative creameries in the state. Many of the creameries engage in several side lines of business such as cultured buttermilk, powdered milk, ice cream, ice cream mix, buying and selling of poultry products, curing meat, and selling feed and fuel.

Thirteen cheese plants manufactured 7,762,097 pounds of cheese, and five condenseries manufactured 34,923,548 pounds of condensed milk in 1936*. Mississippi has forty-eight ice cream plants which manufactured 1,221,133 gallons of ice cream in 1936. There were 101,684,162 pounds of milk purchased by condenseries, and 9,316,633 pounds of cheese manufactured in Mississippi in 1937. Sometimes these plants are run in connection with creameries or other dairy manufacturing plants.

PRESENTATION OF RESULTS

Farm Practices

There was an average of 4.8 persons in the operator's family, and an average of one tenant family on each operator's farm.

Each farm received an average of $27.56 of soil conservation payments, and one-fourth of the farmers received some income from working off of the farm. The average cost of ginning was $5.00 per bale. The average amount of unpaid family labor was $77.20 per farm. An average of $68.55 taxes was paid on the 38 owner operated farms. Only seven farmers had insurance, and these seven farms had an average of $26.46 of insurance per farm.

The farmers surveyed had farm experience ranging from two to forty years, the average number of years of farm experience for all surveyed producers being thirteen years. Only one farm studied had all pure-bred cattle that were registered or subject to registration. Jersey was the predominant breed kept, the average herd having 75 per cent Jersey blood.

Two-thirds of the dairymen kept one or more bulls, of which 50 per cent were pure bred and slightly less than 50 per cent registered. Grade bulls with several years of line breeding were commonly used. Sixty-six per cent of the dairymen practiced letting the bulls run in the pasture with the dairy herd.

Pastures furnish the cheapest and best feed for livestock when they are

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*Department of Agriculture and Commerce report, State of Mississippi, Jackson, Miss., 1938.

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This permanent pasture is seeded to a suitable pasture grass mixture, is kept mowed, and the cattle are rotated from one pasture to another. It furnishes economical feed for the cattle for the greater part of the year.

properly handled and the fertility is properly conserved. Since the use of good pastures is a recognized economy of production, methods of producing better pastures are an important factor to consider when making a detailed analysis of dairy costs. The average pasture, on the farms studied, furnished grazing for about seven months per year, often on land of medium or low fertility which was rather heavily infested with bitter weed. Some combination of paspalum, bermuda, carpet grass, lespedeza, blue grass, red top, and white clover constitute the most common grasses and legumes used in pastures; however, many other legumes are used in the various communities, such as bur clover, black medic, spring or narrow leaf vetch, hop clover, alfalfa, alsike clover, and red clover. Other grasses which will grow well in this area are: English and Italian rye, rescue, tall oat, broome, orchard, and fuzzy oat grass.

Very few farmers attempted rotation or fertilization of pastures, although this practice would not only produce more feed, but cheaper and better feed. About half of the farmers mowed part of the pasture. An average of two and one-half acres of pasture was required to carry a cow, the range being from 1 to 10 acres. It was a general practice to graze the workstock with the dairy herd, while some farmers also grazed sheep with the herd.

Thirty-six per cent of the dairymen bred the cows to calve in the spring exclusively, while the majority practiced all the year round freshening. Only a few farmers bred cows to calve in the fall.

Milk was sold to the Borden plants of Starkville and Artesia, to the Co-operative Creamery at State College, and to Swift and Company at West

Point. Largest quantity of the milk was sold at Starkville, where milk is marketed at the Borden Plant twice daily, except during the cooler season when it is sold only once daily and where milk and cream are delivered to the Cooperative Creamery daily in the summer and every other day in the winter. Practically all the milk and cream are hauled by a privately owned truck hired by the patrons on the particular milk route served. However, the Cooperative Creamery owns and operates two cream trucks. The average price paid for hauling butterfat was 2.21 cents per pound. The average per cent of butterfat of milk sold to the Borden and Kraft plants was 4.01. The average price paid for butterfat sold from August 1, 1936 to August 1, 1937 was 40.2 cents per pound.

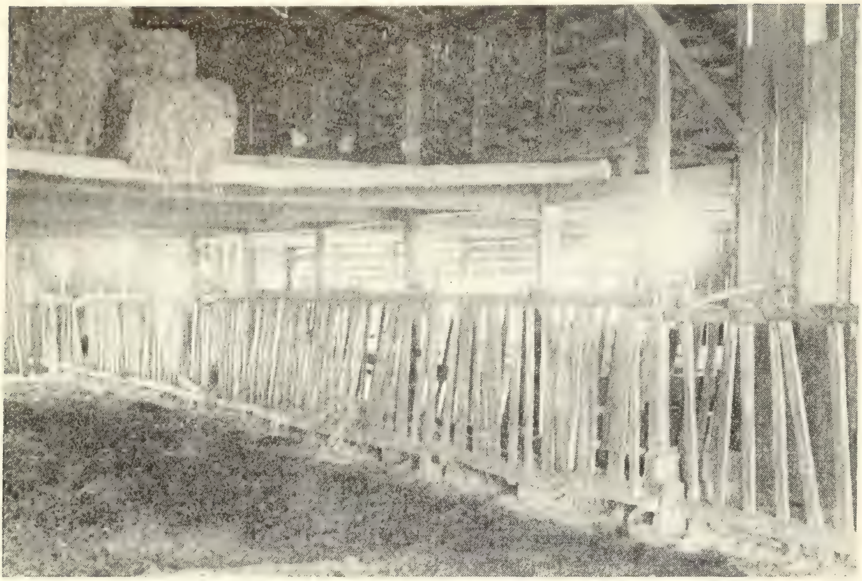
Sixty-four per cent of the dairymen used family labor exclusively, while eighteen per cent used cropper labor altogether.

Two-thirds of the farmers had milk delivered immediately after milking and did not practice cooling the milk. One-third of the producers cooled milk in water during the hot season of the year before delivery when milk was delivered twice a day, and at other seasons when the milk was being delivered once a day.

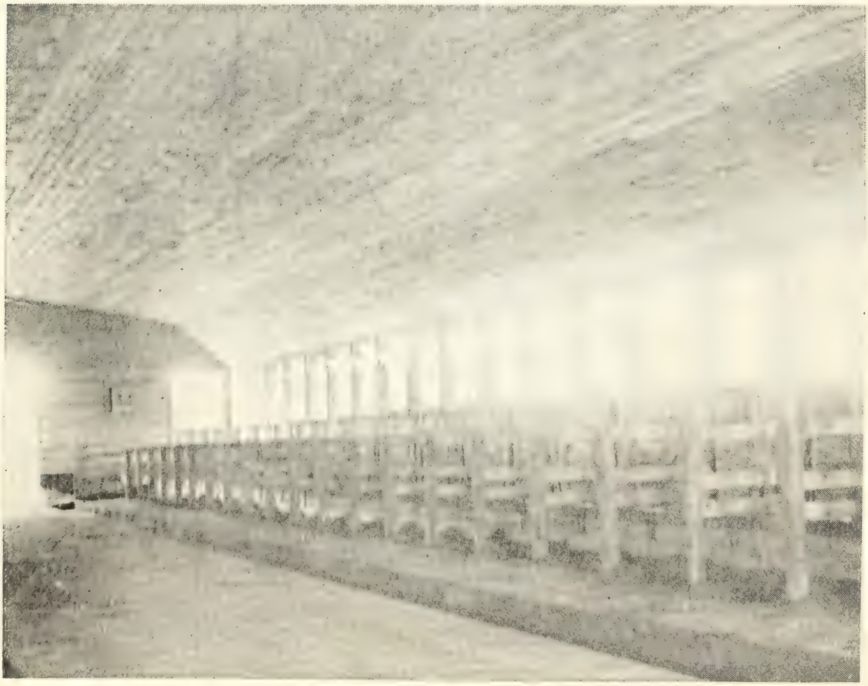
Twenty out of the fifty-six dairymen interviewed stated that they did not practice culling. Three-fourths of the dairymen sell aged and undesirable cows of low production to local buyers and butchers.

The average dairyman in this wholesale area, in addition to his milk production, also grows livestock for replacement and for sale. The growing of a

This dairy barn with a capacity for 50 cows cost about $1,000. A number of silos are found on dairy farms in this region. Trench silos are used by a few farmers.



This type of milking shed with dirt floor is undesirable from the standpoint of the production of quality milk and cream.



This is one of the better dairy barns in the area studied. The concrete floor is inexpensive and is conducive to the production of quality milk and cream.

limited number of heifers is an integral part of the dairy industry and represents a real cost in the production of milk. Skill in growing heifers, handling cows, and disposing of older animals without great depreciation are very important in the management of the individual dairy farm. Since more economic production is probably obtained when cows are in their prime, the cows should not be sold at that time except at attractive prices.

Unfortunately, the farmer who has but a few cows cannot afford to purchase a pure-bred bull from highest producing ancestry. A few cooperative bull associations well governed would probably be profitable with more uniform methods of production, a higher plane of dairying in general, and a cooperative spirit. The ownership of good sires might encourage the purchase of higher producing cows to serve as foundation cows.

Herd health was an important factor affecting the returns from sales of livestock. The most common causes given for the death of cows were digestive troubles, black leg among calves, old age, accidents, Bangs, parasites and starvation. While Bangs is, no doubt, the disease that causes the greatest economic loss, other diseases are mastitis or garget, dysentery, and pink eye. Most common parasitical trouble reported among young stock was stomach and intestinal worms.

Water is provided for the cattle, in most cases, from pools, and the supply is often inadequate during the hot dry season in the summer and fall. Usually the cattle wade in the pools and contaminate them. Since an ample supply of pure water is necessary, deep pools on well selected soil with a small amount of evaporation surface are desirable, and the water from the pool should be siphoned to a trough where practical.

The amount of feed fed, especially roughage, based on recommended feeding standards, was generally low. Less than half of the dairymen raised any of the concentrates fed, corn being the principal concentrate raised, while ninety-four per cent raised most of the roughage. Most producers failed to adjust grain ration to quality of roughage, and some even ignored the difference in cost of rations. Very few farms fed so-called "Stock Foods", and forty per cent of the dairymen fed the milk by-products on the farm. Seventy per cent of the growers cooperated with the Agricultural Adjustment Administration program.

Fifty-four per cent of the dairymen stated that additional cows should be included in their herds to operate most economically. Fifteen per cent of the dairymen said their herds were too large for the farm set-up. Thirty-one per cent of the producers felt that their herds were of the most economical size.

Only nine per cent of the dairymen surveyed were members of a cow testing association. Oktibbeha County's milk testing association had during the fiscal year, March, 1937-1938, an average of twenty-four members, and the average number of cows tested for the year was 632*. The cost of membership in this association is only $3.00 per month, and it furnishes one of the most useful farm records. It is supervised by the Mississippi Agricultural Extension Service, in cooperation with the U. S. Department of Agriculture.

The lowest number of crop acres per mule was 5.6 acres in the case of a highly specialized efficient dairy farm where there was no cotton grown and where a large per cent of the feed was bought. (See Table 14.) The highest crop acres per mule were 62.5 acres on a farm with two mules, and where 100 acres of Johnson grass hay were grown. The average number of acres of crop land per mule was 19.4. An average of three work animals were kept per farm varying from zero on two farms to 9 on one farm. The lowest number of animal units per 100 farm acres was 2 on a farm with a large per cent of wood, idle land, and waste land. The highest number of animal units per 100 acres of farm land was 55.6 on a small farm of only 43.5 crop acres. The average number of animal units per 100 acres of crop land was 20.5.

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*Dairy Extension Report, L. A. Higgins.

The per cent of crop land in cotton varied from zero on nine farms to 66 per cent on one farm, the average being 25.3 per cent. The farms having no cotton in most cases had less than average net profits, this being due in part to the fact that the average price received for cotton was 12.30 cents per pound.

The lowest cash receipts per mule was $112, the highest was $1,438, and the average was $563. The cash expenses per mule ranged from $89 to $1,011, and averaged $355, while profits per mule varied from zero to $722.

Although in this area more dairy cattle were kept than any other class of livestock, practically all farmers raised hogs, the average number of brood sows per farm being 1.36. Hogs in this area are given a variety of feeds, but they are raised largely on skim milk and finished principally on corn. They are kept largely for home use or to sell locally, although some hogs are trucked or shipped to Birmingham and Tuscaloosa, Alabama, St. Louis, Missouri, and Memphis, Tennessee. A number of feeder hogs are transported to Tupelo, Mississippi, and sold there to buyers who ship or truck them to the corn belt. Hog production may be considered as supplementary to dairy production rather than as a competing enterprise, being utilized with calves and poultry to consume skim milk from the dairy herd.

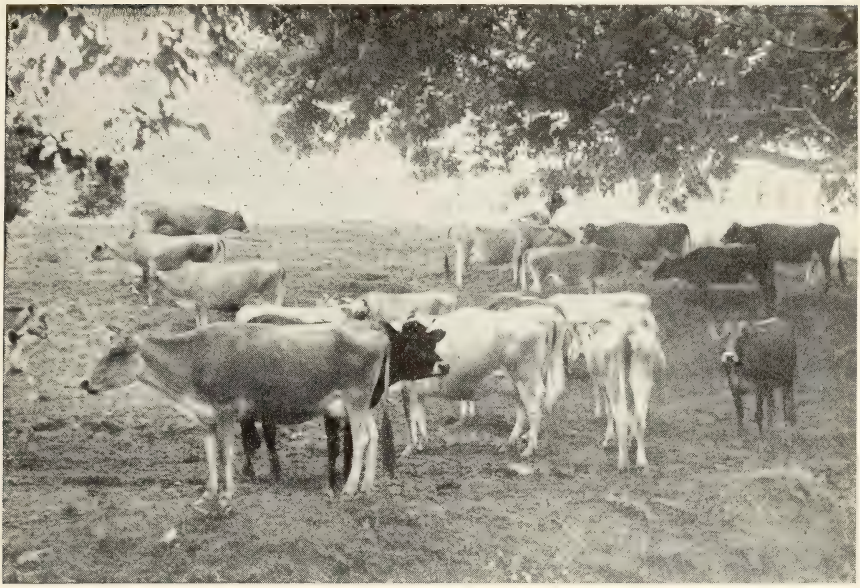
The crop yields were somewhat better than the state averages for the same crops, as reported by the 1935 census. Forty-seven out of the fifty-six farmers produced cotton (See Table 15). The highest acreage of cotton per farm was ninety, while the average acreage was thirteen. The yield per acre varied from 143 to 625 pounds of lint cotton, the average yield per acre for the total acres on all forty-seven farms being 313 pounds. The average production of cotton per farm was 3,992 pounds of lint cotton, or about eight bales.

In general, the most successful farmers in this study had a business as large as or larger than the average, production of crops and animals as good as or better than average, and enterprises so combined that labor, land and feed were used in the most profitable manner.

Fifty-four out of the fifty-six farmers surveyed grew corn, averaging 25.3 acres per farm with an average production of 514 bushels per farm. The weighted average production per acre was 20 bushels. Thirty-four farmers grew hay, which is a cash crop on some of the farms. An average of 20 acres of meadow and 26 tons of hay were grown per farm. Small quantities of miscellaneous crops like sweet potatoes, Irish potatoes, peanuts, cowpeas, lespedeza, soybeans, sugarcane, and sorghum were grown on the various farms.

Size of Business

A proper size is necessary for the most successful development of any business. While it is natural to select the number of cows as the means of determining the relative size of a dairy farm, Table 11 contains several other factors which may be used in determining the size of any individual unit. The average number of cows per farm was 18.5, ranging from 5 cows on farm



One of the better dairy herds of the area consisting of one hundred per cent registered Jersey cattle.

number 3 to 78 cows on farm number 16 (See Table 11). The amount of butterfat sold per cow per farm ranged from 28 pounds on an 8 cow farm to 272.5 pounds on a 27 cow farm, and averaged 101.6 pounds on all farms. The average amount of butterfat sold annually per farm was 1,814 pounds.

There was a direct correlation between the size of herd and the total profits per farm as shown in Table 1. There was also a direct correlation between the number of acres of cotton and total profits per farm (Table 2).

Table 1. Relation Between Size of Herd and Profits per Farm in Oktibbeha and Lowndes Counties, Mississippi, 1936-1937.

Number of Cows	Number of Farms	Profits
30 and above	9	$1,033.78
20-29	16	935.50
10-19	14	568.50
Less than 10	17	490.53

Table 2. Relation Between Acres of Cotton and Profits per Farm in Oktibbeha and Lowndes Counties, Mississippi, 1936-1937

Acres of Cotton	Number of Farms	Profits
20 and above	10	$1,030.80
10-19	13	730.31
1-9	24	662.17
0	9	541.78

Table 3. Relation Between Size of Herd and Production per Cow in Oktibbeha and Lowndes Counties, Mississippi, 1936-1937

Size of Herd	Number of Farms	Average No. of Cows	Average Prod. per Cow
30 and above	9	40.33	88.58
20-29	16	23.13	104.03
10-19	14	13.57	102.58
Less than 10	17	6.59	105.65

Farms with herds of less than thirty cows had the highest production per cow (Table 3). The fact that the average farmer has a number of cows that are dry from three to five months during the year partly explains this low butterfat production per cow. This low average butterfat production is an important factor and partly explains the small incomes and profits.

It is economical to keep cows producing throughout the year, in winter as well as in the spring and summer. No doubt the cost of producing milk is cheaper in the spring and summer; however, the price paid for butterfat is lower at this season of the year.

There was considerable range in the farm acreages on which the study was made. The average was 251 acres, ranging from 30 to 1,462 acres (Table 11). The crop area on these farms ranged from 0 to 378 acres and averaged 62.7. It is quite obvious that on farms having a small crop area and with relatively large herds, a larger percentage of the necessary feed had to be purchased. The number of workstock ranged from 0 to 9, and the average was 3.2 per farm. The total farm investment averaged $4,445, ranging from $418 to $18,998. The dairy receipts averaged 42.3 per cent of the total cash receipts and ranged from 8.5 per cent to 96.1 per cent. Nine farms did not grow cotton, but cotton and cottonseed averaged 35.8 per cent of the total cash receipts on all farms.

Summary of Incomes

For the year ending July 31, 1937 the net profits of fifty-six farmers in Oktibbeha and Lowndes counties varied from $1.00 to $2,486 (See Table 12). Seventeen farmers had net profits ranging from $919 to $2,486; nineteen others ranged from $503 to $868; and the twenty lowest varied from $1 to $483.

Why such differences in net profits? Some of these variations in returns can be attributed to the differences in size measured by total investment in the farm, the number of cows, acres in farm, acres in crops, and productive man work units. Differences in quality, as measured by crop yields, pounds of butterfat sold per cow, and the per cent of butterfat of milk are also causes of variations in the net profits. Still other variations are associated with labor efficiency, feeding, fortunate selections of breeding, personal factors, and chance.

The average rate of interest earned on investment was 16.2 per cent, ranging from minus 2.9 per cent on an owner farm with an average inventory of $4,265 and with no cotton and only 8 dairy cows, to 60.4 per cent on a cash renter farm with an average investment of $1,242 with cash income of $408 from cotton and cottonseed and with 20 cows.

The estimated value of the operator's labor varied from zero in the case of four farm operators to $400 on one farm, and averaged $127 on all farms. The operator's labor and management wage averaged $849 on all farms. The interest on investment at 4 per cent ranged from $17 to $584, and averaged $178. The average labor income was $523, ranging from minus $131 to plus $1,868. The farm income averaged $703 and ranged from $37 to $2,454. The average farm had $1,818 of farm receipts and $1,115 of farm expenses, and the average inventory for all farms was $4,445.

Distribution of Capital

Total farm investment is one of the best measures of size of farm. The distribution of capital, as shown in Table 4, indicates that the capital in land amounts to 43 per cent of the total investment. Investment in buildings rank second, being 21 per cent. Livestock represents 17 per cent, equipment 10 per cent, and workstock 8 per cent of the total capital investment.

Table 4. Distribution of Capital in Lowndes and Oktibbeha Counties, Mississippi, 1936-1937

Items	Average Investment	Per Cent of Total Investment
Land	$1,912	43.02
Buildings	935	21.03
Livestock	759	17.08
Equipment	465	10.46
Workstock	374	8.41
Totals	4,445	100.00

Value of Inventories

Nineteen out of fifty-six farmers did not own land and buildings (See Table 13). The average value of the land per farm was $1,912, while the average value of buildings was $935. Expensive buildings were not commonly used, although it appeared that better housing facilities for cows on many of the farms would have been an economical investment. The equipment averaged $465 and the workstock $374 per farm, and there was an average value of $759 of livestock on the farms. The dairy products contributed an average of $709, and the cotton enterprise an average of $600 per farm to the cash receipts. For all the farms of the group, dairy expenses averaged $272, and ranged from $7.00 to $1,653.

The largest single item of cash expense on the dairy farms was for feed. The more common dairy feeds bought were cottonseed meal, wheat bran, hominy feed, alfalfa meal and molasses mixed, and commercial mixed feed running nine per cent protein. Johnson grass bought locally was the principal roughage purchased. Other items included in the dairy expenses were hauling, salt, sales tax, buckets and cans bought and repaired. The sales tax amounted to two per cent of all purchases except on seeds.

An Analysis of Two Individual Dairy Farms

Differences in the return from livestock are largely due to four factors: organization of farm, health of herd, quality of the stock, and skill of the operator.

Farm No. 39 (Tables 11-15) was an example of a successful specialized dairy with no cotton. This was a 27-cow dairy, and its average of 272.5 pounds of butterfat sold per cow during the year compares rather favorably with an average of about 168 pounds of fat per cow for the country as a whole and an average of 275 pounds of fat per cow in Denmark during the year 1936*. The size of the herd was above the average of 18.5 cows, and had close to three times as much as the average production. This farm of 115 acres, which had only 22 acres in crop land, represented a total investment of $11,008. Seventy-two and seven-tenths per cent of the total cash receipts was derived from the sale of dairy products. An additional $600 of farm receipts came in from the sale of dairy cows. The poultry enterprise contributed $419 to the cash receipts. The total farm receipts amounted to $3,994, farm expenses totaled $2,284, leaving $1,710 for the farm income. The operator's labor and management wage amounted to $1,550, and the rate earned on the investment amounted to 13.4 per cent. The net profit on this farm amounted to $1,310, or twice the average for all the farms in this survey. It is important to note that the farm receipts were close to twice the amount of farm expenses. The estimated value of the operator's labor was $240.

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*E. J. Perry, Danish Dairying, N. J. Farm and Garden, Sea Isle City, N. J.

It is evident that this operator's interest and skill with cows was above the average for the group studied. The quality of dairy cattle kept on this farm—being either registered or subject to registration—the feeding practices, the knowledge of the dairy business, and the management of the dairy herd, all were far above the average for the two counties. The cost of feed bought, however, was above the average, but the production was also above the average. Greater profits might have been made by growing more of the concentrates on the farm. This would have given a better distribution of labor, but would have necessitated purchasing or renting more land. Also, since this was a profitable year for cotton, the addition of a few acres of cotton would probably have increased the net profits on this farm.

Farm No. 41 (Tables 11-15) is an example of an efficient dairy farm in which cotton ranked second to dairying in the cash receipts. This farm, with an average of 20 cows in the herd, is slightly larger than the average farm in this survey. Production of 150 pounds of butterfat sold per cow is also above the average of 101.6 pounds for the group. Since the operator is a cash renter, the total investment is only $1,239. For this farm of 404 acres with only 89 acres in cultivation, the farm receipts amounted to $1,686 and farm expenses to about $768, leaving $918 as the farm income. The operator's labor and management wage amounted to $1,168 and the rate earned on the investment was 60.4 per cent. The net profits on this farm amounted to $998. The farm receipts were more than twice as great as the farm expenses. The cash dairy receipts amounted to $1,181, as compared with an average of $709 for the group, while the cash dairy expenses were only slightly less than one-third of the average. About seventy per cent of the total cash receipts came from the dairy enterprise, twenty-four per cent came from cotton and cottonseed, and six per cent from miscellaneous sales.

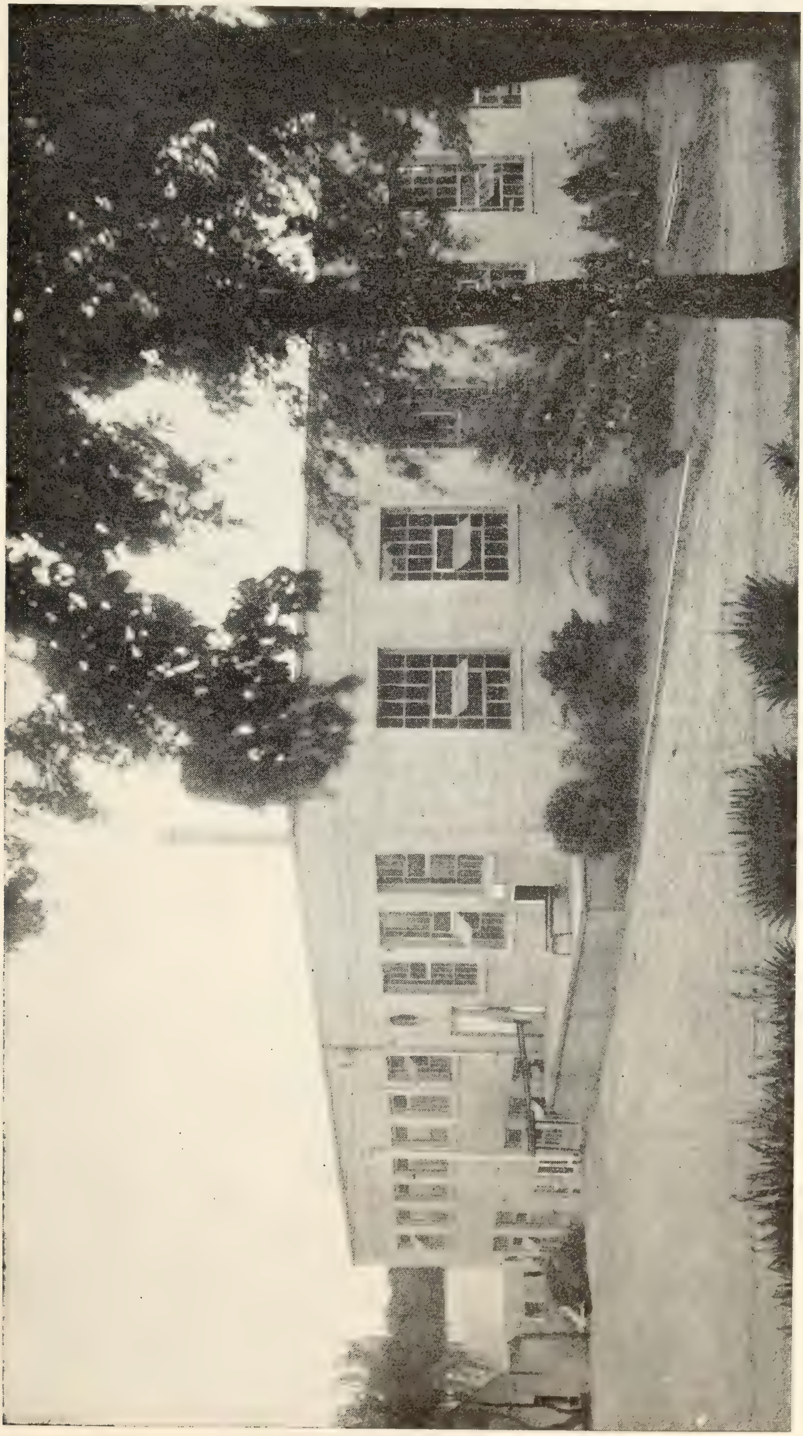
MARKETING PRACTICES

Marketing Factors and Prices

Milk is a bulky and perishable product, and is usually sold on local markets for processing and retail distribution. Cream is about four to six times lighter than is milk in proportion to value, and therefore a wider range of markets is available to producers of cream than of milk.

Mississippi dairymen are concerned with national markets for a number of dairy products such as butter, cheese, evaporated milk, condensed milk, and milk powder, since prices on the large markets govern prices in all sections of the country, and since dairy products produced in Mississippi, like those of the United States at large, have marked seasonal trends.

Prices of cream are based on butterfat test and grade. The Cooperative Creamery, at State College, purchases cream on the basis of three grades; namely, sweet cream, number one sour cream, and number two sour cream. A premium of five and eight cents per pound is paid for sweet cream over number one sour cream and number two sour cream. Only the sweet cream is used at the Cooperative Creamery, while both grades of the sour cream are sold to other dairy plants. The milk bought by the creamery is based on one grade. It must be sweet and clean, and is paid for on the basis of butterfat test.



The Cooperative Creamery located at State College, Mississippi provides a good market for cream and milk.

The Cooperative Creamery produces one grade of butter called sweet cream butter with a score ranging from 90-93; it produces also cultured buttermilk, powdered buttermilk, and powdered skim milk. The Cooperative Creamery also purchases for and distributes to its patrons feed, seeds, and gasoline and oil. The dairy products produced at the Cooperative Creamery are hauled largely by trucks to southern towns and cities, while some butter is hauled by rail in refrigerator cars as express to New York, Philadelphia, and Chicago. A number of the dairymen do not manufacture butter for home use on the farm, but buy their butter from the Cooperative Creamery.

The Borden Plant at Starkville buys milk on one grade, based on butterfat test and condition. The milk must be sweet, clean, and have a satisfactory sediment test. These conditions apply to other dairy plants in the area, whether purchasers of milk, or cream, or both. The Borden Plant produces only one product, namely, sweetened condensed milk, which is all sold in the South and is moved by freight. New Orleans is by far the largest market for this product. This condensed milk is sold all over Mississippi, Alabama, Florida, Georgia, and Louisiana.

Quality is an important factor in the marketing of dairy products. While there is limited inspection of dairy farms by the local fieldman of the plants, some milk is produced under very unsanitary conditions, and more uniform inspection is desirable. The state employs one man who inspects dairy plants for sanitation, and especially butterfat tests and grading of the cream at the plants. All of the creameries have a state licensed grader who grades the cream and makes visits to their patrons and inspects the conditions under

Table 5. Average Monthly Gross Price Paid for Butterfat at the Cooperative Creamery at State College, Mississippi, 1935-1937. (Based on the fat in Cream.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.
1935	36.0	39.0	35.0	36.0	27.0	25.0	24.0	26.0	27.0	29.0	34.0	36.0
1936	36.0	37.0	36.0	33.0	29.0	34.0	38.0	40.0	40.0	37.0	38.0	38.0
1937	38.0	38.0	39.0	35.0	33.0	32.0	34.0	35.0	37.0	38.0	40.0	39.0
3 yr. av.	36.7	38.0	36.7	34.7	29.7	30.3	32.0	33.7	34.7	36.7	37.3	37.7

Table 6. Total Pounds of Butterfat Handled Monthly by the Cooperative Creamery at State College, Mississippi, 1935-1937.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1935	19,523	20,523	31,483	57,539	74,063	73,221	75,193	57,626	50,045	42,437	32,052	19,964
1936	19,126	21,070	30,460	48,990	73,298	66,482	70,037	67,382	46,924	38,487	25,752	18,159
1937	20,599	26,491	39,103	50,854	78,710	86,740	86,652	70,169	62,875	51,383	33,220	32,106
3 yr. av.	19,749	22,695	33,682	52,461	75,357	75,481	77,294	65,059	53,281	44,102	30,341	23,410

Table 7. Average Monthly Gross Price Paid for Butterfat at Borden Plant in Starkville, Mississippi, 1935-1937. (Based on the fat in whole milk).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.	ct.
1935	38.0	42.0	39.0	40.0	32.0	28.0	27.0	29.0	30.0	32.0	37.0	39.0
1936	39.0	40.0	38.0	36.0	32.0	36.5	41.0	43.0	44.0	40.5	40.5	40.5
1937	40.5	40.0	42.0	37.5	36.5	36.0	36.5	38.0	41.0	41.0	43.0	42.0
3 yr. av.	39.2	40.7	39.7	37.8	33.5	33.5	34.7	36.7	38.3	37.8	40.2	40.5

which the milk is produced. The Borden Plant in Starkville has one man employed for this purpose. Thirty thousand three hundred and fifty-eight milk and cream cans were inspected in the state from June 7 to August 7, 1937 inclusive*.

The average monthly prices paid per pound of butterfat at the Cooperative Creamery at State College and the Borden Plant at Starkville are shown in tables 6 and 8. May, June, and July constitute the seasons of highest production and lowest prices of butterfat.

The prices for butter, taking the United States as a whole, decreased rapidly from 1929 to 1933, and since then have gradually risen to slightly above the normal or pre-war butter prices. (See table 9). Over a period of years, there is less percentage fluctuation in butter prices than in the prices of most other farm products. Mississippi butter prices are very much the same as those of the United States. The New York and Philadelphia prices of butter are usually the highest in the country and are generally about one or two cents higher than the Chicago prices for the same quality of butter. The United States prices are somewhat higher than the New Zealand price. (See table 9). The spread in prices between summer and winter is generally 3 to 5 cents a pound. (See table 10).

The greatest dairy problem in Oktibbeha and Lowndes counties is not a marketing problem, but is one of efficiency in the production of quality dairy products.

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*Department of Agriculture and Commerce report, State of Mississippi, Jackson, Mississippi, 1938.

Table 8. Total Pounds of Milk and Butterfat Handled Monthly by the Borden Plant at Starkville, Mississippi, 1935-1937.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Lbs. Milk 1935	832,387	994,874	1,611,358	2,984,034	4,202,432	4,170,049	4,067,498	3,239,539	2,536,814	1,838,704	1,345,761	903,138
Lbs. Butterfat 1935	41,453	45,385	69,626	131,101	184,631	182.788	180,121	146,393	123,734	98,832	77,164	51.451
Lbs. Milk 1936	979,950	1,143.181	1,834,277	2,984,665	4,286,142	3,743,759	3,967,105	3,892,258	2,778,773	2,082,578	1,305,277	900,911
Lbs. Butterfat 1936	51,545	56,930	79,757	128,927	186,353	161,528	177,604	180,618	136,926	113,004	77,873	52,339
Lbs. Milk 1937	1,086,169	1,342,757	1,989,238	3,190,505	4,551,753	4,510,366	4,546,339	3,989,756	3,286,580	2,233,301	1,427,240	1,240,239
Lbs. Butterfat 1937	54,820	63.386	89,238	136,581	193,805	192,701	198,435	182,247	160,108	123,955	84,365	70.051
3 yr. avg. Milk	966,169	1,160,271	1,811,624	3,053,068	4,346,779	4,141,391	4,193,647	3,707,184	2,867,389	2,051,528	1,359,426	1,014,763
3 yr. avg. Butterfat	49,273	55.234	79,540	132,203	153,930	179,006	185,387	169,753	140,256	111,930	79,801	57,947

Table 9. Butter Prices for 92 Score Creamery by Years in United States and Leading Markets in cents per Pound. 1927-1936*

Years	United States	New York	Phil.	Chicago	New Zealand
1927	44	47	48	46	35
1928	46	47	48	46	37
1929	45	45	46	44	38
1930	35	37	37	35	30
1931	25	28	29	27	23
1932	18	21	22	20	16
1933	19	22	23	21	15
1934	23	26	27	25	17
1935	28	30	31	29	21
1936	32	33	34	32	32

*The United States Price is that received by producers. The New Zealand price is for creamery first grade. All quotations are from Agricultural Statistics, U. S. Department of Agriculture, 1937.

Table 10. Butter Prices by Months in the United States and Leading Markets in cents per Pound*.

Months	United States	New York	Phil.	Chicago	New Zealand
Jan.	33	34	35	33	25
Feb.	33	35	36	34	25
Mar.	33	34	35	34	25
April	32	34	34	32	25
May	30	31	32	30	25
June	29	31	31	30	26
July	29	31	32	31	27
August	30	33	34	32	26
Sept.	32	34	35	33	26
Oct.	33	35	36	33	26
Nov.	33	35	36	34	25
Dec.	33	35	36	34	24

*The figures are on the same basis as those in Table 9. They are averages for the years 1927-1936 inclusive.

TABLE 11. INDICATIONS OF SIZE OF BUSINESS

In Oktibbeha and Lowndes Counties, Mississippi 1936-1937

Farm No.	* Average number of cows	Average butter fat sold per cow	Total butter fat Sold	Tenure of** operation	Size of farm	Crop Area	Number of work stock	Total farm invs'nt	Dairy receipts is to total cash receipts	Cotton & cotton seed is to total cash receipts
		Lbs.	Lbs.		Acres	Acres		$	%	%
1	10.0	116.8	1,168	O	95	27	2	3,186	55.0	33.7
2	15.0	103.3	1,549	O-CR	61	33	3	3,620	50.4	46.0
3	20.5	90.7	1,859	O-CR	190	46	4	4,922	42.2	33.2
4	5.0	109.1	382	O	80	65	2	2,598	8.5	82.0
5	16.0	115.1	1,841	O	160	79	4	4,663	25.6	62.4
6	30.0	123.5	3,705	O	220	27	3	12,179	68.6	29.0
7	41.0	83.2	3,413	CR	309	49	3	2,682	50.0	——
8	30.0	41.6	1,248	O	200	69	4	6,705	48.0	51.4
9	24.0	80.9	1,941	O	64	22	1	4,337	96.1	——
10	14.0	109.4	1,531	O	141	51	5	5,366	59.6	24.2
11	6.0	127.5	765	O	152	33	2	3,795	29.6	52.6
12	23.0	78.4	1,803	O-CR	319	127	7	7,824	28.2	60.2
13	8.0	28.6	229	O	60	24	2	4,202	40.2	——
14	25.0	112.4	2,810	CR	180	33	4	1,743	70.5	25.4
15	8.0	131.3	1,050	O	65	16	2	2,297	57.5	40.2
16	78.0	76.2	5,943	CR	1,310	76	3	3,746	67.6	16.9
17	16.0	64.2	1,027	O	120	38	2	5,369	27.6	29.8
18	5.0	105.2	526	SHR	138	25	2	669	47.3	48.3
19	14.0	42.3	592	CR	79	15	2	529	56.0	40.3
20	5.0	102.4	512	O	30	22	1	1,834	27.3	65.4
21	5.0	89.4	447	O	94	14	1	2,064	52.7	40.8
22	6.0	217.3	1,304	CR	165	17	1	435	72.7	23.5
23	20.0	99.0	1,979	O	175	67	2	6,979	40.6	33.3
24	26.0	115.1	2,993	O	213	69	6	7,567	61.8	30.4
25	26.0	102.8	2,672	O	160	46	2	7,242	60.6	8.5
26	7.0	102.0	714	O	120	39	3	5,362	21.0	72.1
27	15.0	108.0	1,620	O-CR	104	17	2	2,446	53.6	13.4
28	38.0	83.6	3,176	CR	400	70	2	1,778	43.2	23.2
29	6.0	90.3	542	O-CR	80	51	3	1,907	18.4	81.6
30	7.0	128.4	899	SHR	83	16	2	588	51.5	43.7
31	6.0	84.3	506	O	83	41	2	2,818	13.6	31.8
32	13.0	94.7	1,231	O	200	57	4	5,632	34.1	59.2
33	20.5	37.9	777	O-CR	440	231	8	8,047	8.8	81.9
34	15.0	145.3	2,180	O	127	46	7	2,919	68.2	23.9
35	8.0	63.3	506	O	71	21	1	2,553	77.5	——
36	9.0	90.0	8.0	O	114	43	3	3,480	40.7	47.5
37	22.0	66.5	1,463	O	170	107	5	5,233	22.9	61.8
38	11.0	107.8	1,186	CR	766	37	3	1,166	78.3	——
39	27.0	272.5	7,358	O	115	22	4	11,008	72.7	——
40	6.0	44.2	265	STR	32	20	2	587	15.2	83.9
41	20.0	149.9	2,998	CR	404	89	4	1,239	70.4	24.3
42	15.0	86.7	1,300	SHR	342	141	4	1,074	20.3	32.4
43	12.0	44.7	530	STR	44	42	2	1,044	22.6	72.9
44	30.0	105.1	3,153	O	1,462	67	4	10,312	42.1	40.1
45	50.0	126.3	6,313	O	580	76	4	18,998	78.4	17.7
46	9.0	186.1	1,675	O	280	125	2	8,789	31.7	30.5
47	28.0	116.1	3,251	CR	640	139	3	2,666	31.5	8.9
48	32.0	99.9	3,196	O	360	0	0	9,898	90.0	——
49	24.0	60.6	1,454	O	160	35	2	3,499	32.5	51.1
50	20.0	57.6	1,152	CR	280	71	2	3,346	22.6	37.7
51	20.0	127.7	2,554	SHR	800	378	9	5,103	14.2	48.2
52	24.0	59.5	1,428	CR	141	0	0	918	92.2	——
53	6.0	116.8	701	SHR	76	25	2	418	34.5	62.3
54	13.0	108.2	1,406	O	72	27	2	3,594	90.7	——
55	34.0	59.0	2,006	O-CR	471	214	6	14,605	18.4	39.1
56	11.0	211.8	2,330	SHR-CR	270	172	4	1,361	53.4	34.6
Average	18.5	101.6	1,814		251	62.7	3.2	4,445	42.3	35.8

*Milked during the year.

**O—Owner; CR—Cash Renter; O and CR—Owner and Cash Renter; SHR—Share Renter; STR—Standing Renter; SHR and CR—Share Renter and Cash Renter.

TABLE 12. SUMMARY OF FARM INCOME

In Oktibbeha and Lowndes Counties, Mississippi 1936-1937

Farm No.	Average Inventory	Farm Receipts	Farm Expense	Farm Income	Labor Income	4% Interest on Investment	Op'rators labor & Management Wage*	Estimated value of o'rators labor	Return on Investment	Rate earned on investment	Net Profit**
	$	$	$	$	$	$	$	$	$	%	$
1	3284	944	365	578	451	127	683	180	398	12.5	503
2	3708	1291	1012	280	135	145	543	170	110	3.0	373
3	4964	1669	997	672	475	197	961	672	——	13.7	961
4	2654	1762	7789	973	869	104	1150	96	877	33.7	1054
5	4692	2624	2027	598	411	187	843	135	463	9.9	708
6	12307	2387	1273	1115	630	487	1055	60	1055	8.6	995
7	3065	3299	2459	840	733	107	1149	135	705	25.3	1014
8	6909	1467	565	902	634	268	1079	160	742	11.0	919
9	4466	1562	873	689	516	173	659	225	464	10.7	434
10	5438	1075	530	545	330	215	865	120	425	7.9	745
11	3797	740	287	454	302	152	674	160	294	7.7	514
12	7824	2536	1783	553	440	313	1163	105	648	8.2	1058
13	4265	351	314	37	—131	168	161	160	—123	—2.9	1
14	1881	1753	1186	567	497	70	612	72	495	28.4	540
15	2315	754	242	512	420	92	791	105	407	17.7	686
16	3759	3433	3034	399	249	150	448	45	354	9.5	403
17	5655	2014	1214	800	586	215	1012	180	620	11.6	832
18	668	414	285	129	102	27	323	80	49	7.3	243
19	633	610	340	271	249	21	448	100	171	32.2	348
20	1572	745	504	244	171	73	417	90	154	8.4	327
21	2080	371	147	224	143	83	377	135	89	4.3	242
22	455	754	604	150	133	17	398	80	70	16.0	318
23	6927	1920	1346	574	295	279	621	160	414	5.9	461
24	7614	2171	797	1374	1072	302	1310	120	1254	16.5	1190
25	7325	1877	484	1393	1103	290	1543	100	1293	17.6	1443
26	5352	1301	716	586	371	214	601	125	461	8.6	476
27	2477	1240	900	340	242	98	579	96	244	10.0	483
28	1660	2875	1923	952	881	71	1059	30	922	51.8	1029
29	1889	1189	968	221	145	76	398	115	106	5.6	283
30	657	774	447	327	303	24	532	160	167	28.4	372
31	2839	1052	383	669	556	113	874	105	564	20.0	769
32	5594	1421	932	489	264	225	593	105	384	9.5	588
33	7913	3531	3208	323	1	322	284	180	143	1.8	104
34	2984	1386	643	743	626	117	927	80	663	22.7	847
35	2590	327	89	238	136	102	329	105	133	5.2	224
36	3525	851	329	522	383	139	596	65	457	13.1	531
37	5325	2750	1302	1449	1239	209	1335	60	1389	26.5	1275
38	1237	854	587	267	220	47	482	120	147	12.6	362
39	11024	3994	2284	1710	1270	440	1550	240	1470	13.4	1310
40	600	612	266	346	323	23	551	90	256	43.7	461
41	1242	1686	768	918	868	50	1168	170	748	60.4	998
42	1318	2937	2354	583	540	43	825	200	383	35.6	625
43	1075	856	346	910	464	47	1001	135	375	35.9	866
44	1318	2701	1546	1155	742	412	1195	160	995	9.7	1038
45	19034	3526	2246	1280	519	760	610	670	1279	6.7	670
46	8815	1911	763	1247	796	352	1351	90	1057	12.0	1260
47	2923	4187	2797	1390	1283	107	1569	175	1215	45.5	1394
48	9417	1662	780	882	486	396	750	——	882	8.9	750
49	3670	1888	999	889	749	140	1048	180	709	20.0	868
50	3179	1897	1490	407	274	134	849	180	227	6.8	669
51	5001	7120	5348	1772	1568	204	1914	200	1572	30.8	1714
52	921	897	372	525	488	37	679	130	395	4.5	549
53	486	908	550	358	341	17	758	180	178	4.2	578
54	3759	938	454	485	341	144	632	400	85	2.4	232
55	14617	4360	1808	2452	1868	584	2486	——	2452	16.8	2486
56	1307	1736	1402	334	279	54	687	240	94	6.9	447
Average	4445	1818	1115	703	523	178	849	127	576	16.2	724

*Net profit plus estimated value of operator's labor.

**Farm income plus value of products produced on farm and used in farm household, minus interest on total investment at 4 percent, minus estimated value of operators labor.

TABLE 13. VALUE OF INVENTORIES AND MISCELLANEOUS RECEIPTS

In Oktibbeha and Lowndes Counties, Mississippi 1936-1937

Farm No.	Land	Buildings	Equipment	Work Stock	Livestock	Total Cash Receipts	Cash Dairy Expenses	Cash Cotton & Cottonseed Receipts	Cash Dairy* Receipts
	$	$	$	$	$	$	$	$	$
1	1131	1048	344	240	423	747	254	252	411
2	1238	1135	200	290	757	1115	362	513	562
3	1356	1818	458	400	891	1582	227	525	668
4	1744	396	152	160	146	1649	19	1352	140
5	1750	1450	350	400	713	2566	669	1600	657
6	4152	4900	1286	300	1541	2132	697	619	1463
7	—	—	480	250	1957	2448	1429	0	1224
8	3940	820	213	550	1182	9221	150	474	443
9	1512	1425	660	100	641	1341	370	0	1289
10	2965	1257	149	470	525	931	275	225	555
11	1726	1260	437	180	192	736	19	387	218
12	3808	2015	680	680	666	2536	175	1527	716
13	1092	2285	215	270	339	224	12	0	90
14	—	—	657	185	901	1476	259	375	1055
15	1031	382	258	280	346	716	123	288	412
16	—	—	348	300	3099	3407	1145	574	2304
17	3286	940	707	210	226	1741	173	430	398
18	—	—	225	245	199	414	47	200	196
19	—	—	52	200	278	402	118	162	225
20	410	615	175	440	194	748	34	489	204
21	1170	472	139	140	144	338	19	138	178
22	—	—	109	115	212	714	251	168	519
23	4063	1513	459	150	794	1920	314	640	779
24	4502	915	567	303	775	1913	185	581	1183
25	3481	2510	352	70	330	1733	54	148	1050
26	3335	885	307	450	385	1301	66	938	273
27	50	871	512	300	714	1178	349	158	631
28	—	—	211	250	1318	2875	379	666	1243
29	751	575	230	180	171	1189	101	970	219
30	—	—	157	185	246	678	151	296	349
31	1441	645	200	260	272	1009	50	321	137
32	2538	1651	351	625	468	1421	257	841	485
33	3635	1200	839	1545	828	2531	101	2892	309
34	889	750	265	500	515	1255	175	300	856
35	1433	605	167	35	313	253	41	0	196
36	1965	637	244	300	334	783	126	372	319
37	2661	1241	286	475	570	2565	160	1585	587
38	—	—	504	295	367	607	419	0	475
39	4600	3165	700	405	2138	3960	1653	0	2877
40	—	—	148	250	189	584	7	490	89
41	—	—	133	520	586	1677	110	408	181
42	—	—	444	120	510	2448	157	795	496
43	—	—	343	190	511	792	14	577	179
44	3663	2450	2550	550	1099	2687	305	1077	1130
45	11616	3625	609	1050	2098	3452	237	612	2707
46	4522	2885	681	80	621	1859	269	567	590
47	—	—	1109	400	1157	3672	1602	325	1157
48	8506	455	11	—	924	1398	101	0	1258
49	1600	400	75	300	1124	1744	60	891	567
50	—	—	845	700	1802	1897	191	715	428
51	—	—	2560	1980	563	7120	201	3434	1008
52	—	—	212	—	712	577	147	0	532
53	—	—	106	130	182	770	130	480	266
54	1722	960	335	75	502	605	20	0	549
55	7785	2200	945	750	2925	4235	139	1654	778
56	—	—	361	600	400	1716	112	594	917
Average	1912	935	465	374	759	1678	272	600	709

*Cash Dairy Receipts does not include sales of cattle.

TABLE 14. INDICATIONS OF EFFICIENCY FACTORS

In Oktibbeha and Lowndes Counties, Mississippi 1936-1937

Farm No.	Number of acres of crop land per mule	Number of animal units per 100 farm acres	Percent of crop land in cotton	Cash receipts per mule	Cash expenses per mule	Profits per mule
			%	$	$	$
1	13.5	17.1	18.5	373	183	521
2	11.0	42.2	48.5	372	339	124
3	11.5	25.4	15.2	396	249	240
4	32.5	11.8	30.8	824	395	527
5	19.8	20.2	57.0	642	507	177
6	9.1	29.9	66.0	711	424	332
7	16.3	27.4	00.0	816	820	338
8	17.1	26.1	17.5	231	141	230
9	21.8	41.4	00.0	1341	873	434
10	10.3	25.5	13.7	186	106	149
11	16.3	8.3	24.6	368	143	257
12	18.1	11.2	28.5	362	237	151
13	12.0	28.0	00.0	112	157	000
14	8.1	22.0	23.0	369	297	135
15	8.0	23.4	25.0	358	121	343
16	25.2	7.4	11.9	1136	1011	134
17	19.0	8.8	16.0	721	607	416
18	12.5	7.7	19.8	207	135	122
19	7.5	26.7	46.7	209	170	174
20	21.5	45.6	32.6	748	483	327
21	13.5	9.2	22.2	338	147	242
22	16.5	6.7	42.4	714	604	318
23	33.6	24.3	11.9	960	621	231
24	11.4	19.3	11.7	319	133	198
25	23.0	36.5	5.4	867	242	722
26	13.0	15.4	26.9	434	233	159
27	8.5	28.0	26.9	589	450	242
28	35.0	10.2	17.9	1438	803	515
29	16.8	15.6	39.6	396	311	142
30	8.0	20.0	31.3	339	224	124
31	20.5	16.3	9.8	504	192	384
32	14.1	12.5	35.4	355	214	147
33	28.9	8.2	19.5	441	368	13
34	6.6	24.9	32.0	179	92	121
35	21.0	24.4	00.0	253	89	224
36	14.3	15.2	18.6	261	110	177
37	21.4	23.7	34.6	513	260	255
38	12.3	2.0	00.0	202	196	121
39	5.6	37.4	00.0	990	571	327
40	10.1	34.9	39.5	392	133	231
41	22.3	9.4	13.5	419	192	250
42	35.3	5.9	10.6	612	589	156
43	20.8	55.6	20.5	396	173	433
44	16.5	51.9	30.2	672	387	259
45	19.0	14.2	21.0	863	562	168
46	62.5	6.7	7.2	930	382	630
47	46.3	8.3	5.0	1224	932	465
48	00.0	12.3	00.0	0	000	000
49	17.5	22.2	51.4	872	495	434
50	35.5	19.7	14.0	949	578	334
51	42.0	6.4	23.8	791	572	190
52	00.0	21.6	00.0	000	000	000
53	12.2	16.9	41.3	385	275	289
54	13.4	32.4	00.0	303	227	116
55	35.7	17.6	20.6	706	301	414
56	43.0	10.6	9.3	429	351	112
Average	19.4	20.5	25.3	563	355	264

TABLE 15. CROP PRODUCTION AND DISPOSITION SUMMARY

In Oktibbeha and Lowndes Counties, Mississippi 1936-1937

	COTTON			CORN			MEADOW			SWEET POTATOES		
Farm No.	Acre	Lint Yield Per Acre	Total Lint Yield	Acre	Yield Per Acre	Total Yield	Acre	Yield	Yield Per Acre	Acre	Yield	Yield Per Acre
		lbs.	lbs.		bu.	bu.		ton	ton		bu.	bu.
1	5.0	338	1688	14	13	180	3	6	2.00	¼	30	120
2	16.0	219	3500	15	10	150	60	32	.53	¾	72	96
3	7.0	471	3300	30	18	550	37	23	.62	1½	200	133
4	20.0	425	8500	38	21	780	6	14	2.33	¼	60	240
5	45.0	244	11000	22	13	280	10	5	.50	½	40	80
6	18.0	222	4000	6	15	90	—	—	—	¼	40	160
7	—	—	—	20	15	300	25	30	1.20	1½	200	133
8	12.0	250	3000	40	10	400	15	25	1.67	—	—	—
9	—	—	—	14	15	210	—	—	—	¼	5	20
10	7.0	214	1500	12	20	240	20	40	2.00	1	180	180
11	8.0	321	2566	15	23	350	—	—	—	½	30	60
12	36.0	292	10500	65	20	1300	—	—	—	1½	210	140
13	—	—	—	16	27	430	—	—	—	½	50	100
14	7.5	320	2400	8	18	140	16	48	3.00	1.50	60	40
15	4.0	500	2000	11	15	160	—	—	—	.125	10	63
16	9.0	389	3500	24	34	400	40	80	2.00	1.00	150	150
17	6.0	467	2800	17	20	350	—	—	—	.25	30	120
18	5.0	300	1500	12	17	200	4	6	1.50	.25	15	60
19	7.0	171	1200	7	21	150	—	—	—	.25	100	400
20	7.0	429	3000	11	27	300	2	7	3.50	1.00	50	50
21	3.0	333	1000	9	11	100	—	—	—	.25	15	60
22	7.0	143	1000	7	7	50	—	—	—	.25	25	100
23	8.0	625	5000	10	20	200	25	105	4.20	—	—	—
24	8.0	500	4000	35	20	700	16	35	2.19	—	—	—
25	5.0	200	1000	22	34	750	8	35	4.38	.75	120	160
26	10.0	572	6000	20	19	380	—	—	—	.25	60	240
27	4.0	250	1000	12	17	200	—	—	—	—	—	—
28	12.0	384	4800	15	20	300	40	90	2.25	.50	100	200
29	20.0	300	6000	20	6	120	7	14	2.00	1.00	55	55
30	5.0	400	2000	7	30	210	—	—	—	.25	30	120
31	4.0	497	1988	23	16	368	6	12	2.00	.50	50	100
32	20.0	260	5200	26	15	397	—	—	—	.50	125	250
33	45.0	422	19000	130	20	2600	50	50	1.00	1.00	125	125
34	15.0	167	2500	17	15	250	—	—	—	.50	68	136
35	—	—	—	12	7	80	5	5	1.00	1.00	50	50
36	8.0	313	2500	24	20	480	2	3	1.50	.25	60	240
37	37.0	270	10000	39	22	1100	—	—	—	1.00	200	200
38	—	—	—	20	15	300	10	10	1.00	—	—	—
39	—	—	—	10	40	400	—	—	—	—	—	—
40	8.0	375	3000	5	30	150	6	11	1.83	.25	40	160
41	12.0	250	3000	35	22	800	40	60	1.50	—	—	—
42	15.0	333	5000	25	20	500	100	100	1.00	—	—	—
43	3.0	441	3750	20	21	420	10	20	2.00	1.00	100	100
44	20.0	375	7500	35	29	1000	—	—	—	—	—	—
45	16.0	250	4000	47	18	640	6	12	2.00	—	—	—
46	9.0	400	3600	14	19	260	100	100	1.00	1.00	160	160
47	7.0	314	2200	30	12	355	100	108	1.08	—	—	—
48	—	—	—	—	—	—	—	—	—	—	—	—
49	18.0	334	6000	10	15	150	11	20	1.82	—	—	—
50	10.0	450	4500	25	24	600	35	30	.85	.75	80	107
51	90.0	278	25000	134	39	5200	150	200	1.33	—	—	—
52	—	—	—	—	—	—	—	—	—	—	—	—
53	10.0	300	3000	14	13	176	—	—	—	—	—	—
54	—	—	—	15	13	200	—	—	—	.50	—	
55	44.0	230	10100	100	15	1500	10	10	1.00	—	—	—
56	16.0	250	4000	55	12	700	100	100	1.00	—	—	—
Average	12.7	313	3992	25.3	20	514	20	26	1.29	.44	53.7	122

Bulletin No. 325 September, 1938

Sweetpotato Plant Production in Mississippi

by

W. S. Anderson

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
State College, Mississippi

CLARENCE DORMAN, Acting Director

Sweetpotato Plant Production in Mississippi

By W. S. Anderson, Associate Horticulturist

In the production of sweetpotato plants the essentials to success are good seed stock, suitable propagating beds, suitable bedding medium, proper bedding methods, and proper attention to pulling and care of the plants. In this paper brief consideration is given to each of these essentials. The information is designed to be of practical benefit to Mississippi growers.

GOOD SEED STOCK

Disease Freedom. Seed stock sweetpotatoes should be produced so as to be free of all diseases which cause decay losses during storage and low production of plants in the beds. The best way to be assured of this is to use vine cuttings for growing the seed crop and set these cuttings on disease-free land. If new land is available, it is by all means preferred; but, if it is not available, use land that has not grown a crop of sweetpotatoes in at least five years. The diseases which cause sweetpotato rots live only on sweetpotatoes, and if this crop is not grown on the land for several years the diseases die.

Seed Size. The roots kept for seed should be the small sizes from high producing hills. The work of many investigators as well as the experience of growers show that the small roots produce more plants per bushel than the large roots. During 1935, 1936, and 1937 work was done by the writer at Laurel to compare the sprouting of "small" and "large"* seed of the Triumph variety and the yielding ability of plants from the two sizes of seed. The results of these experiments are presented briefly in tables I, II, and III.

These data show that while there were more plants produced per root by the "large" seed, these plants were not significantly larger than those produced by the "small" seed. Almost twice as much weight of root of the "large" seed was required to produce a plant as of the "small" seed. The "small" seed produced more plants per bushel early in the season and for the entire season than the "large" seed. While the difference of 312 plants per bushel may seem small, it is a significant difference.

While the data in table III show that in some cases a few more bushels of roots were produced by plants from "large" seed, these differences are not significant, and considerable variation in the yield of individual plots in the field occurred. In the light of these experiments, growers are justified in using small seed.

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*The "small" seed included roots that were 1 to 1½ inches thick and the "large" seed included roots that were 2 to 3½ inches thick.

Table I. Effect of Size of Seed Stock on Plant Production of the Triumph Sweetpotato; Summary of Three Years Results

Seed Size	No. Plants Per Root			Grams Root Per Plant			No. Plants Per 60 lb. Bushel		
	1935	1936	1937	1935	1936	1937	1935	1936	1937
Large	12.7	15.8	5.2	22.4	21.6	54.1	1215	1255	502
Small	6.6	8.3	4.1	17.5	12.4	23.6	1612	2190	1152
Difference	6.1	7.5	1.1	4.9	9.2	20.5	397	935	650

Table II. Effect of Size of Seed Stock on Earliness of Sprouting and Total Plant Production of the Triumph Sweetpotato, Three Year Average

Seed Size	Plants Produced Per Bushel by 10-Day Periods			Total Plants
	1	2	3	Per 60 lb. bu.
Large	219	243	383	845
Small	256	265	636	1157
Difference in favor of small seed	37	22	253	312

Table III. Effect of Size of Seed Stock on Yield of the Triumph Sweetpotato; Average of Two Years Results

Plot Pair	Seed Size	Yield Per Acre in 60 lb. bu.				
		Jumbo	No. 1	No. 2	Culls	Total
1	Large	62	195	28	19	304
	Small	49	194	31	12	286
2	Large	11	217	25	14	267
	Small	29	215	25	13	282
3	Large	15	203	26	26	270
	Small	12	202	19	21	254
4	Large	40	195	29	21	285
	Small	47	159	32	17	265
Average	Large	27	202	27	20	276
	Small	34	192	27	15	268

Harvest Date. Sweetpotatoes that are to be used for seed should by all means be harvested before any frost occurs. Results of experiments by Lauritzen (3) show that sweetpotatoes do not need to be frozen or "frost bitten" to be injured so that little or no sprouting occurs. If they are chilled by temporary exposure to temperatures below 40° F they may not sprout. The roots do not freeze until their temperature reaches 29° F. When the vines are injured by frost the roots are likely to be chilled so that although they do not rot in storage, they may be useless as seed stock.

Handling. Experiments (1) have shown beyond doubt that it pays to handle seed sweetpotatoes more carefully during harvesting than is usually practiced by growers. Seed stock that is placed carefully into crates or other containers in which they are to be stored directly from the plowed-up row shrink less and decay less during storage, and produce about twice as many plants per bushel as seed stock that is thrown into heap-rows and subsequently taken up into storage crates. "Carefully" handled seed stock also sprout earlier, thus insuring a greater supply of plants for early setting from a given quantity of seed stock. See table IV.

Table IV. Influence of Handling Seed Stock on Earliness of Sprouting of the Triumph Sweetpotato. 1936.

Treatment	No. of Plants per 60 lb. bu. Seed at Various Pullings									
	1	2	3	4	5	6	7	8	9	Total
"Carefully" handled	269	213	284	160	192	137	139	158	185	1737
"Commercially" handled	0	65	136	125	152	109	135	127	135	984
Difference in favor of "Carefully" handled	269	148	148	35	40	28	4	31	50	753

Curing. The object of curing sweetpotatoes is to heal wounds as quickly as possible and hasten the thickening of the skin to give protection against rot fungi. Wounds heal most rapidly at temperatures between 80° and 85° F. and a relative humidity of 90 per cent. Effective healing will take place in about ten days when potatoes are kept under these conditions. The old idea of curing was that by driving off a lot of moisture the roots were protected from rotting. The newer conception is to keep the roots in a moist atmosphere during curing so as to aid the healing process and to prevent excessive loss of moisture. Only enough ventilation should be given to prevent moisture from forming in drops on the potatoes or on the walls in the curing house. This conception of the curing of sweetpotatoes is the result of exhaustive experiments by Artschwager and Starrett (2), Lauritzen and Harter (4), and Lauritzen (5).

Storing. As soon as the curing period is over (in about ten days) the temperature of the house should be gradually reduced in about two days to around 55° F. If the temperature is lowered too quickly, moisture will condense in the house and rots may start to develop if spores are present. This temperature should be maintained as nearly as practicable throughout the storage period. The relative humidity should be kept as nearly as possible to 85 or 90 per cent. If the house is properly constructed and well insulated, it is not difficult to maintain those conditions by manipulation of ventilators and by keeping pans on the floor filled with water when the humidity drops below 75 per cent.

PROPAGATION

Kind of Bed. Several kinds of propagating beds may be used depending upon the needs or size of operations of the grower. When high total yield is desired, plants must be set early. Early plants can be produced in hotbeds made by any one of several plans. Where sufficient quantities of fresh horse and mule manure are available, a good manure-heated hotbed can be made. Otherwise, various flue-type hotbeds can be made. These may be heated by smoke from wood burning in a fire box at one end being conducted under the bed. Several types of flue beds have been used in Mississippi, and the grower may choose the type best suited to his needs. Hotbeds may also be built so that heat is supplied by steam or hot water being conducted under the bed through iron pipes. Steam may also be exhausted into 3-inch drain tiles laid underneath the bed. In any kind of bed a cloth cover, made of light weight sheeting should be provided. This cover is essential to prevent the cooling effects of spring rains and the rapid loss of moisture by evaporation, and to maintain high humidity in the bed. Sweetpotatoes sprout better at high humidities.

Single Ditch Flue Hotbed. Figure 1 illustrates a flue bed which is very simple in construction. This bed should be not longer than 50 ft. nor wider than 6 ft. To improve drainage from the flue and to help the draft without a tall smoke stack, this bed should be built on a slope with the stack at the higher end. This bed is satisfactory, however, when built on level locations, but a drainage ditch must be provided at the fire-box end and the stack must be about 10 ft. high. As the sketch in Figure 1 shows, the flue of this bed consists simply of a ditch three feet wide, with the sides cut sloping to prevent caving. This ditch is dug in the center of an excavated area which is the same width as the bed. This excavated area is dug out 18 inches deep at the fire-box end and 6 inches deep at the stack end. Some old pieces of junk iron, such as can be found at any junked automobile dumping ground, should be used to cover 12 to 15 feet of the ditch at the fire end. Poles, slabs, boards or anything convenient that will carry the weight of the soil can be

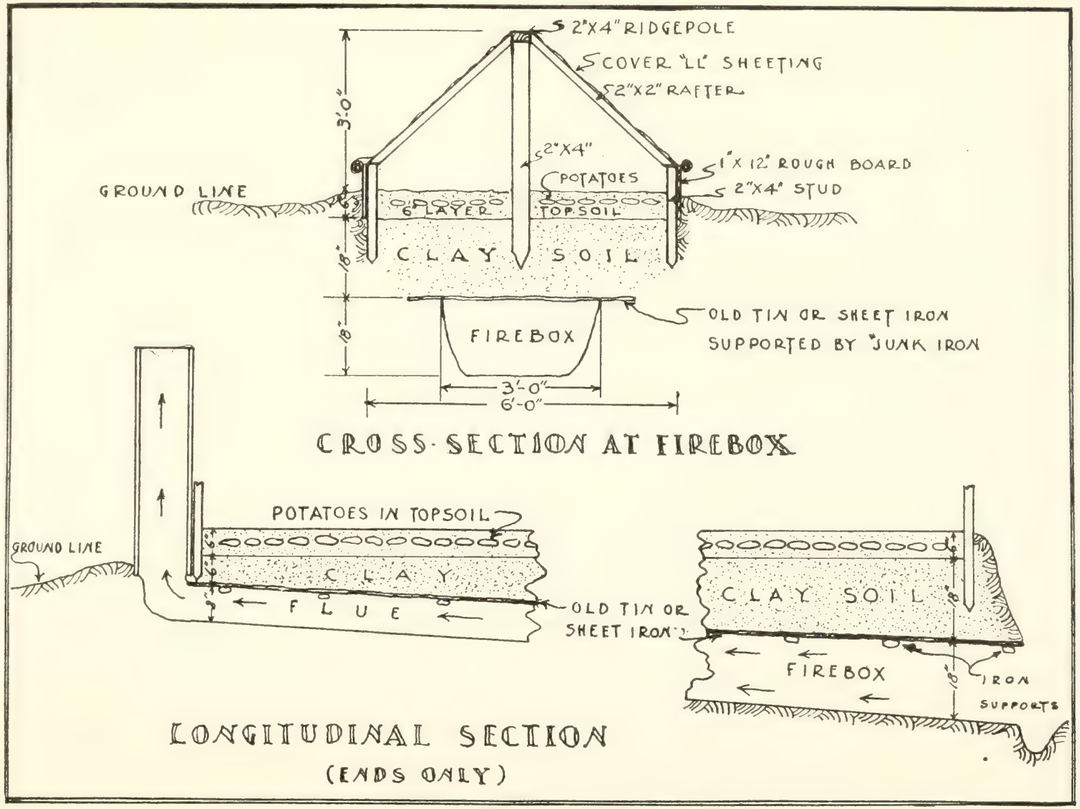
2"X4" RIDGEPOLE
COVER "LL" SHEETING
2"X2" RAFTER
2"X4"
3'-0"
POTATOES
1"X 12" ROUGH BOARD
2"X4" STUD
GROUND LINE
6" LAYER
TOPSOIL
6"
18"
CLAY SOIL
18"
FIREBOX
OLD TIN OR SHEET IRON SUPPORTED BY "JUNK IRON
3'-0"
6'-0"
CROSS-SECTION AT FIREBOX
POTATOES IN TOPSOIL
GROUND LINE
CLAY
FLUE
OLD TIN OR SHEET IRON
CLAY SOIL
FIREBOX
IRON SUPPORTS
LONGITUDINAL SECTION
(ENDS ONLY)

Figure 1. Single Ditch Flue Hotbed

used to cover the remaining part of the ditch. Four 12-inch boards nailed together to form a box makes a good smoke stack and can be easily transported and used from year to year. Clay soil is best for the covering over the flue because it can be tamped until firm and will heat more uniformly than ordinary sandy loam. In the more temporary type structures the side walls of this bed are made of poles, the bedding medium is of new top soil, and at the end of the season nothing is salvaged for use another year except the cover, stack, and irons at the fire box. The temporary bed is built at a new location the next year or in a location where new or disease-free soil is available.

Tile Flue Hotbed. Figure 2 illustrates a flue bed which is somewhat more permanent in structure but more expensive to build than the bed illustrated in Figure 1. In this bed the flues are 8-inch drain tiles. The bed may be wider if more flues are installed. This bed, too, should not be longer than 50 ft. An old 50-gallon oil drum with one end cut out makes a good fire box for this type bed. If a completely permanent structure is desired, the fire box can be built of fire brick and the walls of the bed of concrete or brick. In any event the tiles should be covered with well compacted clay.

Flue Hotbed With Flues Above Ground. Figure 3 illustrates a flue bed which has not been used generally by Mississippi growers, but has proven to be a very satisfactory structure where tried. Several of these beds built by the Mississippi Experiment Station and the Sweetpotato Growers Cooperative Association at the Laurel Starch Plant have produced plants satisfactorily. This type bed may be 10 or 12 feet wide, but not longer than 50 feet. Here again it should be emphasized that the soil covering over the hot air space should be well compacted clay. The fire should be 10 feet from the edge of the bed, and the fire box should be 4 x 4 ft. The combustion chamber should be widened toward the bed so that the smoke may enter the air space throughout the width of the bed. If made of good lumber, concrete or brick, this type bed would last indefinitely with little or no repairs. Made of 2-inch rough cheap lumber it should last for at least three years without repairs. Heat is more uniformly distributed in this type bed than in either the ditch-flue or tile-flue types.

Two-Ditch Flue Type Hotbed. Figure 4 illustrates still another type of flue bed which has been used quite generally by commercial growers in south Alabama. This bed is similar to the one illustrated by Figure 2, differing from it mainly by the sloped ditches instead of tiles serving as flues. This is a less expensive bed than the tile-flue bed, and if made of good lumber it will last for several years. Similar to the bed in Figure 2, drainage from the flues and fire box and the draft will be improved if this bed is built on a slope with the fire box located at the lower end. However, if the fire box is lowered by digging down for the oil drum so that its bottom is about two feet below the level of the bottom of the stack, and if care is taken to see that the soil is banked tightly around the bed so that there are no air leaks, sufficient draft will be obtained. In this bed it is advisable to arrange for a draft control vent over the combustion chamber as illustrated. It can be partly or completely covered by a small piece of tin, as required to obtain the proper draft through the bed. All of the smoke should go through the flues and should come out of the stack practically cool. If it comes out cool, all of the heat is being absorbed by the bed, and the maximum benefit is being obtained from the fire.

This bed is usually built seven feet wide outside measurement. The bedding medium length is 30 feet. Because it provides a very even distribution of heat throughout, this bed is especially good for use in producing very early plants. During 1937 a number of growers in south Mississippi built beds of this type on their farms, and they report very satisfactory results from their operation.

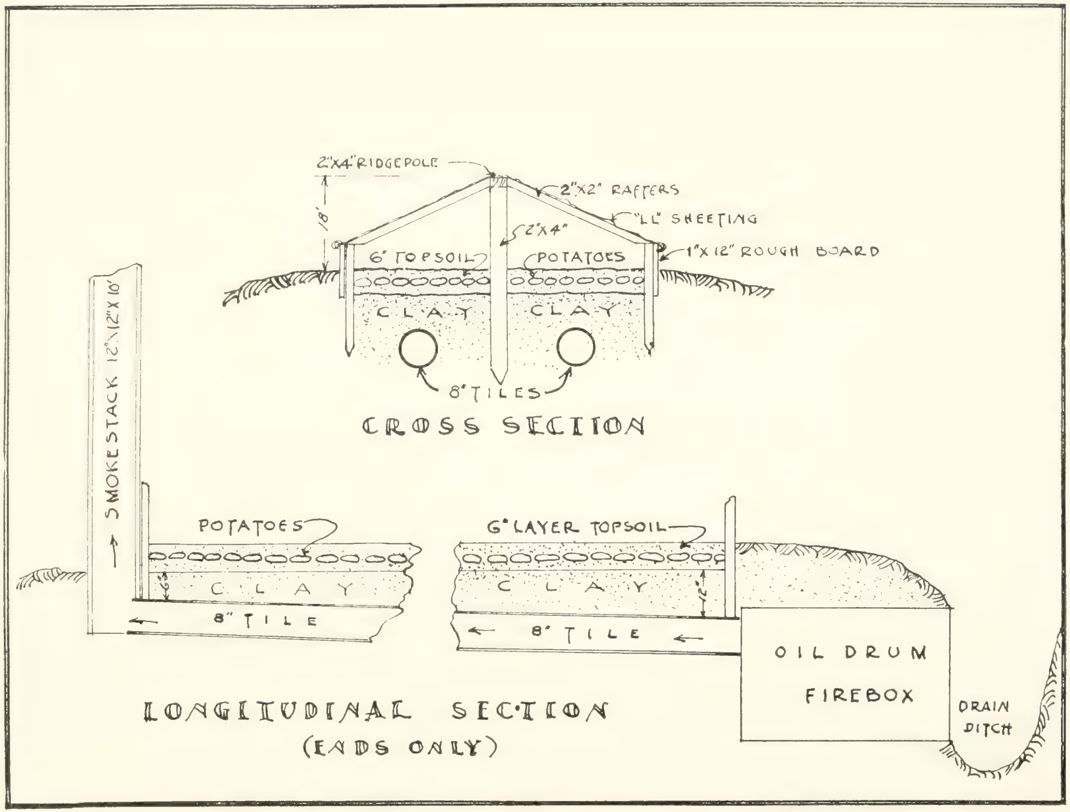
2"x4" RIDGEPOLE
2"x2" RAFTERS
"LL" SHEETING
2"x4"
18"
1"x12" ROUGH BOARD
6" TOPSOIL
POTATOES
CLAY
CLAY
8" TILES
CROSS SECTION
SMOKESTACK 12"x12"x10'
POTATOES
6"
CLAY
8" TILE
6" LAYER TOPSOIL
CLAY
12"
8" TILE
OIL DRUM FIREBOX
DRAIN DITCH
LONGITUDINAL SECTION
(ENDS ONLY)

Figure 2. Tile Flue Hotbed

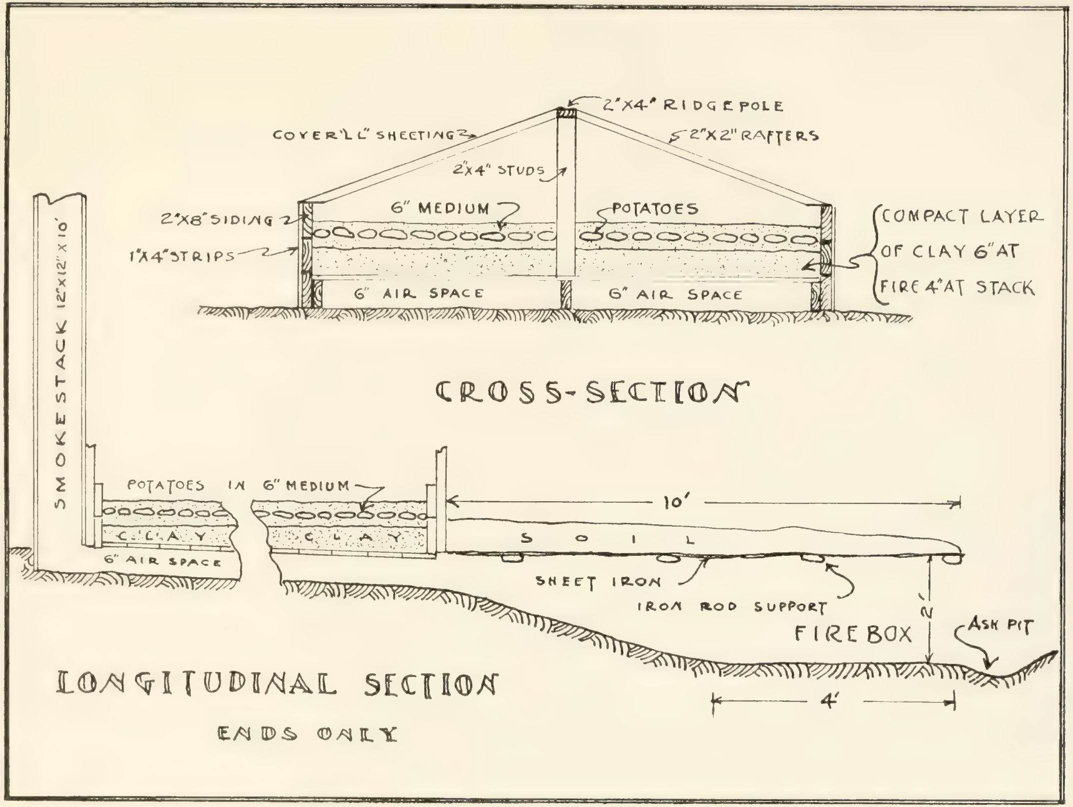
2"X4" RIDGEPOLE
COVER "LL" SHEETING
2"X2" RAFTERS
2"X4" STUDS
6" MEDIUM
POTATOES
2"X8" SIDING
1"X4" STRIPS
6" AIR SPACE
6" AIR SPACE
COMPACT LAYER OF CLAY 6" AT FIRE 4" AT STACK
CROSS-SECTION
SMOKESTACK 12"X12" X 10'
POTATOES IN 6" MEDIUM
CLAY
CLAY
6" AIR SPACE
10'
SOIL
SHEET IRON
IRON ROD SUPPORT
2'
FIREBOX
ASH PIT
4'
LONGITUDINAL SECTION
ENDS ONLY

Figure 3. Flue Hotbed With Flues Above Ground

Bedding Medium. Soil, sand or sawdust may be used as a bedding material. If sandy loam soil that has not before grown sweetpotatoes or plants is used, clean plants can be produced. Soil requires less fertilizer application than sand or sawdust, and less frequent watering than sand. Sawdust beds hold heat longer than soil or sand beds. However, if no bottom heat is used, sawdust beds warm up very slowly by the heat of the sun on the surface. Sand beds get too hot in the latter part of the season unless partly shaded in the middle of the day, and they cool down more quickly during the night than either soil or sawdust beds. The root systems of plants produced in sawdust are larger than those of plants produced in soil or sand. Soil produces larger root systems than sand. If sawdust is used, the older the better. New sawdust is too coarse for bedding material. Sawdust is more easily transported, is easier handled in the beds, and lends itself more easily to steam sterilization than soil or sand. Any of these bedding materials can be easily disinfected with chemicals. No bedding material should be used the second time without being sterilized with steam or treated with bluestone (copper sulphate) solution according to the directions of the Mississippi State Plant Board. If disease occurs in an area in the bed after sprouting starts, the potatoes and bedding material should be removed for several feet around the infected spot and burned. This space should then be disinfected with bluestone (copper sulphate) solution.

Bedding. Seed should be bedded about one month before plants are desired for setting. From 10 to 15 bushels of seed should be bedded for each acre expected to be set from the bed, depending upon the size of the seed. A bushel of seed when properly laid so that the roots do not touch, will occupy approximately 10 sq. ft. of bed space; thus, the standard bed 10 x 50 ft. will provide space for approximately 50 bushels, or 1 bushel per linear foot. Never bed large and small seed together, as small seed may be covered too deep. When ready to bed, the grower should look carefully through the seed stock and discard any roots that have dark spots or show any signs of disease whatsoever. This precaution may save much trouble later on. The roots should be dipped for ten minutes in a solution of 1 ounce of bichloride of mercury dissolved in 8 gallons of water immediately before bedding. The bed should be warmed up to around 85° F before the seed are placed in the bed. The roots should be covered with three inches of bedding medium. Thermometers ought to be placed in the bed so that frequent readings of the temperature can be made and the heat applied accordingly. Use two thermometers, placing one in the coldest and one in the hottest place in the bed. The bed should be kept around 85° F. It is better to keep a slow fire steadily burning than to let the bed cool down and then try to heat it up quickly with a big fire. Watering should be done as often as is necessary to keep the medium moist around the roots. Usually one good watering per week is sufficient. The covers should not be opened except during the day time for two days just prior to pulling dates.

Pulling Plants. Large plants are better than small plants because they transplant more successfully and usually yield more potatoes than small plants. See table V. The first plants usually reach the best size for setting in about four weeks from the bedding of the seed. Successive pullings can be made at 5- to 7-day intervals. Immediately after each pulling the beds should be given an application of a nitrate fertilizer at the rate of 2 pounds per bed 10 ft. x 50 ft., watered, and the covers closed.

Care of Plants. As soon as the plants are pulled, their roots should be immersed in 20-20-50 Bordeaux mixture and then heeled out in damp sawdust in partial shade until they are set or shipped. Experiments by Miles (6) show that this treatment prevents spread of black rot in the heeling-out bed

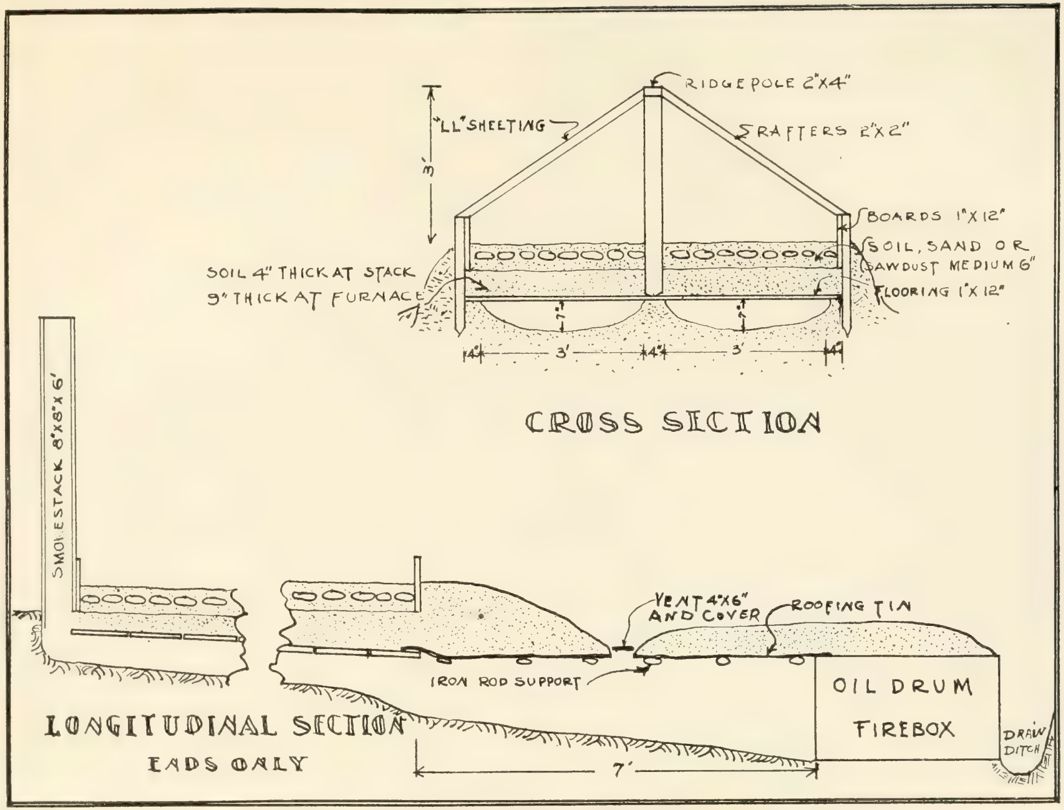
RIDGEPOLE 2"X4"
"LL" SHEETING
RAFTERS 2"X2"
3'
BOARDS 1"X12"
SOIL, SAND OR SAWDUST MEDIUM 6"
SOIL 4" THICK AT STACK
9" THICK AT FURNACE
FLOORING 1"X12"
7"
7"
4"
3'
4"
3'
4"
CROSS SECTION
SMOKESTACK 8"X8"X6'
VENT 4"X6" AND COVER
ROOFING TIN
IRON ROD SUPPORT
OIL DRUM FIREBOX
DRAW DITCH
LONGITUDINAL SECTION
ENDS ONLY
7'

Figure 4. Two-Ditch Flue Type Hotbed

Table V. Effect of the Size of Plants on Yield of the Triumph Sweetpotato, Average of Three Year's Results

Plot Pair	Plant Size	Yield per Acre in 60 lb. bu.				
		Jumbo	No. 1	No. 2	Culls	Total
1	Large	7	297	36	21	343
	Small	10	218	24	23	275
2	Large	14	245	39	21	319
	Small	13	275	33	17	338
3	Large	15	304	36	29	284
	Small	16	224	25	16	281
4	Large	6	291	33	21	351
	Small	22	274	48	24	368
Average	Large	10	279	36	23	324
	Small	15	248	32	20	315

or in the crates during shipment. Roots of plants should never be allowed to dry out, as this results in delayed starting of growth in the field. The plants can be prevented from severe wilting by covering them with wet burlap bags during the interval between pulling and setting in the field. Attention to these details means the securing of good stands. A good stand is important in making good yields, and good yields are essential to obtaining profits.

Certification of Plants. It is illegal in Mississippi to sell or give away seed sweetpotatoes or potato plants that have not been inspected and certified by the State Plant Board. Growers who wish to produce certified seed should apply to the Plant Board at State College before June 15 of each year for field inspections. Certified plants can be produced only from certified seed handled according to Plant Board regulations.

ACKNOWLEDGMENTS

The author is greatly indebted to Professor F. S. Batson, of the Horticultural Department, for making the drawings for the figures in this paper.

LITERATURE CITED

1. Anderson, W. S.—The influence of handling seed stock upon shrinkage, plant production and yield of the Triumph sweetpotato. Miss. Agr. Exp. Sta. unpublished manuscript.
2. Artschwager, Ernst and Starrett, Ruth Colvin—Suberization and wound-periderm formation in sweetpotato and gladiolus as affected by temperature and relative humidity. Jour. Agr. Res. 43; 353-364. 1931.
3. Lauritzen, J. I.—Some effects of chilling temperatures on sweetpotatoes. Jour. Agr. Res. 42; 617-627. 1931.
4. Lauritzen, J. I. and Harter, L. L.—The relation of humidity to infection of the sweetpotato by Rhizopus. Jour. Agr. Res. 33; 527-539. 1926.
5. Lauritzen, J. I.—Factors affecting infection and decay of sweetpotatoes by certain storage rot fungi. Jour. Agr. Res. 50; 285-329. 1935.
6. Miles, L. E.—Treatment of sweetpotato plants for the control of Black Rot. Phytopathology—Vol. 24—No. 11—pp. 1227-1236. 1934.

BULLETIN No. 326 JANUARY 1939

A COMPILATION OF INFORMATION ON

KUDZU

By

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Associate in Soils

and

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Coordinator Research Information

Jointly Representing
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
and
MISSISSIPPI STATE VOCATIONAL BOARD

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KUDZU

Introduction

A great deal of interest is being manifested in Kudzu. The work by the Mississippi Experiment Station on Kudzu is only of three years standing and therefore not complete. However, certain pertinent facts have been found, and because of the general interest in the crop it seems well to release them as soon as possible. This information supplemented with that from other agricultural agencies operating within the state and the experimental results from other states should be helpful in appraising the value of Kudzu for its various uses. The Soil Conservation Service has given the kudzu plant its greatest impetus. It has furnished a great deal of the material that is used in this circular.

Description of Plant

Kudzu (**Pueraria thumbergiana**) is a perennial leguminous vine native to Japan. Its leaves and blossoms resemble those of velvet beans except the leaves are hairy whereas velvet beans are not. The seeds are somewhat similar to speckled peas except the mottling coloration is much more delicate than in peas and the seeds are only about one-fifth as large as peas. The plant has been called "Foot a night vine", "Porch vine", etc. It is quite variable in its soil adaptation and has been grown successfully throughout the Southeastern part of the United States. It has not done well on poorly drained heavy clay soils. This is particularly true of the prairie soils.

Uses of Kudzu

Kudzu requires a great deal of care when establishing the crop, but when it is once established upon an area it is very aggressive. This aggressiveness combined with the viney nature of the plant permits single runners under favorable conditions to grow from 50 to 70 feet long within one growing season. These runners have nodes and wherever a node comes intimately in contact with the soil, roots are set. This rooting habit is shown in figure 1. The internodes die and the rooted nodes become

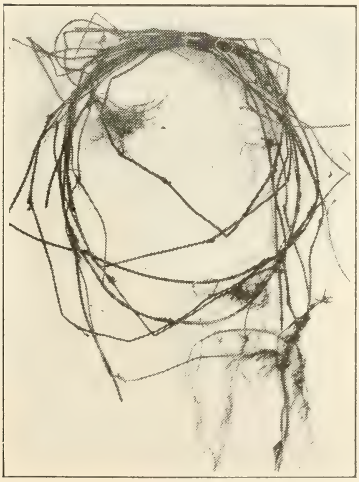

Figure 1. A Kudzu plant with a runner 25 feet long showing how the vine takes roots at the nodes when in contact with the soil. This plant grew from a seed in four months on Oktibbeha sandy loam.

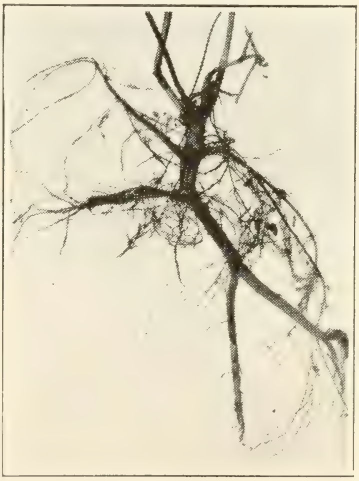

Figure 2. The root system of a Kudzu seedling four months old on Oktibbeha sandy loam.

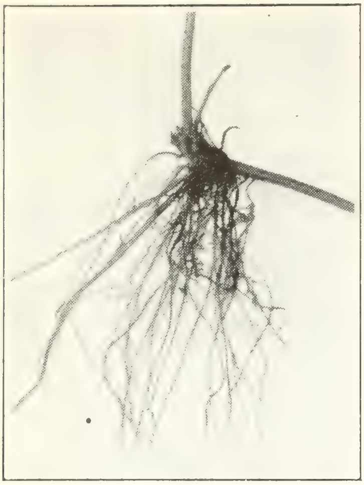

Figure 3. A strong one year old kudzu crown.

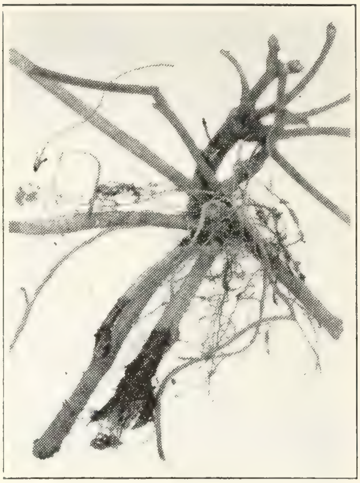

Figure 4. An old kudzu crown. Note nodules and buds.

independent plants and are then called crowns. New plants are usually established by setting these crowns. A successful farmer must of necessity utilize every acre of his land so as to realize its greatest efficiency. There are several uses of Kudzu, any one of which is sufficient to merit more consideration on the part of the farming public than it has had heretofore. This publication gives some information on kudzu when used as, 1, means to control erosion, 2, means to improve the soil, 3, a shade plant, 4, grazing plant, 5, a hay crop, 6, a plant for vegetating terrace disposal systems, 7, a plant for road bank protection, and 8 a pest.

Erosion Control

As an erosion control plant, it is excellent. The ability of the plant to spread over a large area from one central root system and for the vines to take roots at the nodes tieing it securely to the soil, enables one to place the initial plant at the top or side of a gully where the soil is still good or in the bottom of the gully where soil has collected and completely cover and tie down a small gully or galled eroded area within a short time. The entire plant continues to feed for the first season through the central root system, back on the good soil, until the nodes have rooted and become established. By the spring of the second year a strong crown should have caught enough silt to enable it to retain moisture and secure at least a portion of its plant food.

The plant also has done quite well upon areas that have been destroyed and lost from active cultivation due to sheet erosion. In view of the fact that there are vast areas in the Southeastern part of the United States that have been ruined by sheet erosion and since most plants of economic importance with the possible exception of trees will not grow satisfactorily upon such soil, it seems that kudzu might be given serious consideration for such areas. The plant being a legume can manufacture nitrogen which will be helpful to the plant in establishing itself upon eroded and consequently non-productive areas. The nature of the plant is such that it forms a complete coverage when it is well established and therefore protects the soil from the beating and churning effect of the down pouring rains. Coverage is one of the most important features of controlling erosion by means of vegetation. Furthermore the rooting at the nodes ties the vine securely to the soil and has the effect of tieing the soil in

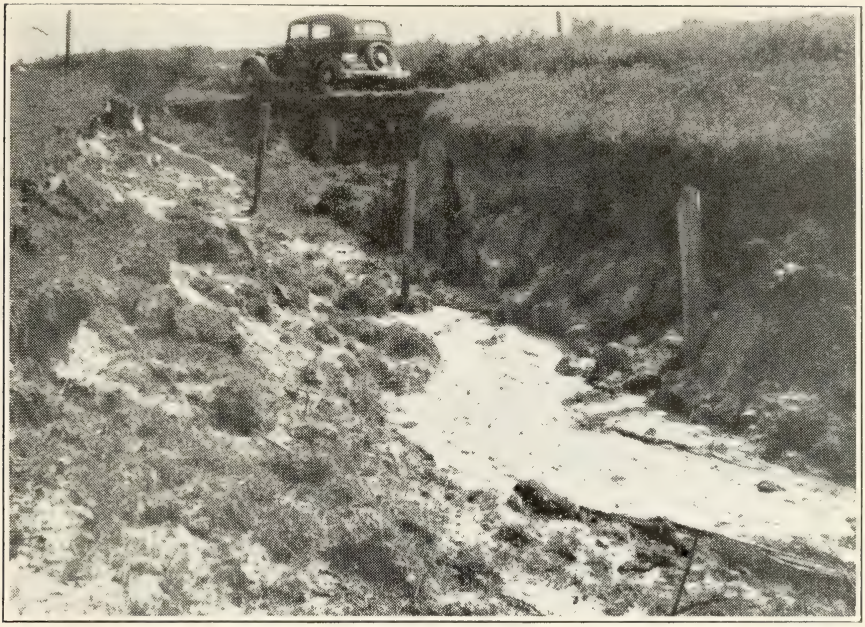

Figure 5. An active gully before treatment.

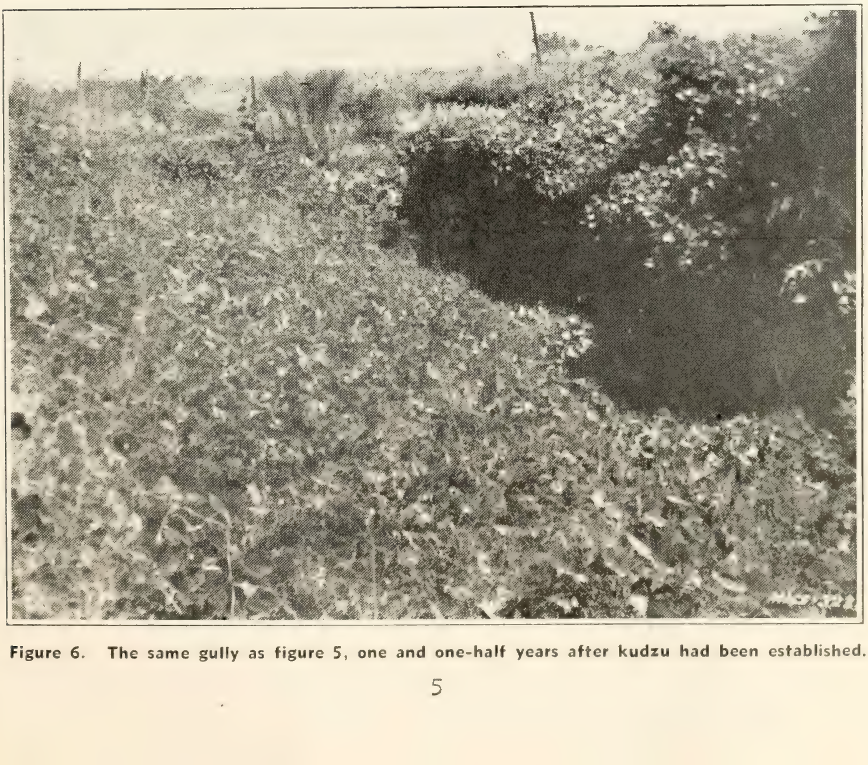

Figure 6. The same gully as figure 5, one and one-half years after kudzu had been established.

place. Figures 5 and 6 show gullies that are being stablized with kudzu. In order for the crop to do well upon severely eroded land, however, it is necessary that a good application of a well balanced fertilizer be applied.

Soil Improvement

As a soil building plant, kudzu has a number of desirable characteristics. It is an aggressive legume capable of making good growth upon poor to average soil; it is quite high in nitrogen content and will grow on a great variety of soils. The vines being tied to the soil at the nodes and growing in every direction forms thousands of miniature dams in every direction and consequently the soil and leaves are kept in place. The large amounts of leaves, roots and vines all remaining on the soil and finally incorporated with the soil will materially increase the organic content of the soil and in turn improve its physical condition. If increasing the organic matter and improving the soil is of primary importance, the entire growth should be left on the soil and undisturbed for at least three or more years.

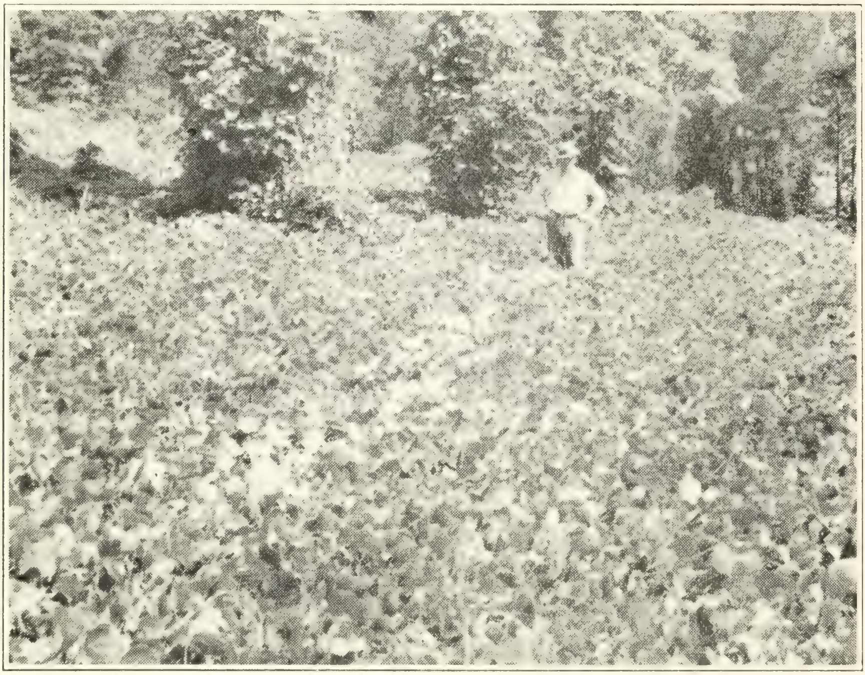

Figure 7. A good growth of kudzu (three years after planting) on Ruston fine sandy loam that had previously been destroyed by sheet and gully erosion.

Since organic matter is the principal source of nitrogen in the soil, it is a very important factor in soil fertility. Humus is the residue left after organic matter has gone through its major stages of decomposition. Humus exerts an important influence upon soil tilth and structure. An ideal state of tilth of the soil is impossible unless it is well granulated. *There is a definite relationship between the amount of humus in a soil and the degree of granulation. The higher the humus content is, the higher the percent of silt and clay that are formed into granules. As the organic matter decomposes, it releases the plant foods that were tied up in the plant. From a nitrogen standpoint this amounts to a great deal, and to a less extent for the phosphorus and potassium. Practically all of this nitrogen is derived from the air and is fixed by the legume bacteria. The phosphorus and potassium are derived from the soil. However, vigorous feeding legumes are frequently capable of extracting considerable amounts of relatively insoluble mineral plant foods from the soil. On the basis of this reasoning it would appear that a good crop of kudzu would increase the supply of available phosphorus and potassium.

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*Missouri Agricultural Experiment Station Research Bulletin No. 212

Table I—Influence of Kudzu on the Yields of Succeeding Crops

	Average yields of following crops		
	2 crops of sorghum hay Lbs. per acre	4 crops of corn Bu. per acre	7 crops of oats Bu. per acre
1. No kudzu	3,264	14.7	16.6
2. Kudzu	5,800	34.0	24.5

Reference: Alabama Agricultural Experiment Station Bulletin No. 232, Experiments with Legumes in Alabama, page 21.

The effect of kudzu upon soil fertility at the Alabama Experiment Station is shown in Table No. 1. This kudzu was planted in the spring of 1916 and turned under in the spring of 1919. During the next ten years, there were two crops of sorghum hay, four crops of corn and seven crops of oats grown on both the kudzu land and land without kudzu. Ten years after the kudzu was turned under, the kudzu plot produced over 9 bushels of oats per acre more than the plot which had never grown kudzu. The nitrogen and phosphorus content of the plant are shown in Table No. 2.

Table II—Comparative Nitrogen and Phosphorus Content of Kudzu and Several Other Legumes

Name of Crop	Nitrogen Content	Phosphorus Content
Kudzu	2.83%	0.27%
Alfalfa	2.35	0.21
Soybeans	2.37	0.25
Cowpea	2.98	0.25

Reference: Feeds and Feeding—Henry and Morrison, 19th Edition, Table 1.

Shade Plant

Kudzu until recently has perhaps been used most as a shade plant. It is particularly adapted to this purpose because of its ability to grow under a wide variation of soil conditions and to make an enormous thick growth and remain for the entire season. It covers a trellis or frame work so thoroughly that it screens the sun out very effectively giving a dense shade. This effect is particularly desirable where porches have Southern exposures.

Grazing Plant

Kudzu has not been used as a grazing crop as much as it has for other purposes. Perhaps one reason why it has not is the fact that indiscriminate grazing usually results in the killing of the crop. It starts growth as early as the climate permits. Frost kills the tender shoots, that sometime come out during a warm period before the last frost. However, this killing does no permanent damage. The runners come out again with the return of warm weather, and if the stand is fairly good the ground is usually covered by June 1 to June 15. The plant is particularly valuable for grazing

Table III—Comparative Feeding Value of Kudzu and Several Other Popular Legume Hays

Kind of Hay	Crude Proteins	Total Digestible Nutrients	Dry Matter
Kudzu	12.0	50.8	90.0%
Alfalfa	10.0	50.3	90.4
Soybeans	11.1	50.6	90.8
Cowpea	12.6	49.4	90.4

Reference: Feeds and Feeding—Henry and Morrison. Table 1, 19th Edition.

since it gets ready just about the time that most of the pastures are suffering from drouth. Kudzu is very satisfactorily grazed when the field is fenced in four parts and graze one area for a period of one week and then rotate to the next field, etc. If closely supervised the kudzu can be profitably grazed until about October 1. It is well to remove the cows at that time so as to permit the crop to store food enabling the plant to withstand the cold winter and to supply food to the plant the following spring until the soil warms up. During the grazing period, care must be exercised to prevent the grazing of the crop too closely, because if it is kept close to the ground for a very long period of time it will certainly die.

Table IV—Kudzu Grazed Continuously

Pasture: 3 acres Kudzu	1935 Apr. 3 to Nov. 5	1936 May 6 to Nov. 11	4-year Average 1933-1936
No. Steers grazed	3	3	3.25
Average initial weight	547	515	479
Average final weight	784	861	698
Average gain per steer	237	346	219
Average gain per acre	237	346	231

References: Georgia Coastal Plain Experiment Station Bulletin 28, Seventeenth Annual Report, page 43, tables 31 and 32, Tifton, Georgia. Georgia Coastal Plain Experiment Station Bulletin 26, Sixteenth Annual Report, page 41, table 33, Tifton, Georgia.

The carrying capacity of kudzu is good. The Animal Husbandry Department of the Alabama Experiment Station have unpublished[*] data which show that an acre of kudzu furnished grazing for an animal unit during a period of 65 days. The Georgia Experiment Station secured even better results than Alabama as is shown in Table No. IV. The average amount of beef produced was 95 pounds per acre.

According to the Animal Husbandry Department of the Mississippi Experiment Station the carrying capacity of permanent pasture for the state of Mississippi varies. From 1 to 10 acres are required for each animal unit producing 150-300 pounds of beef per season. If an average of these figures are taken, it would require five acres of an average pasture to support one animal unit for a season and would amount to 45 pounds of beef per acre. It is true that average pastures, just as average farmers, or average laborers will perhaps never accomplish very much but this crop yielded over twice as much beef per acre as the average Mississippi pasture.

Table V—Yields, in Tons Per Acre of Green Forage on Norfolk Sand from Different Fertilizer Treatment Made Simultaneously with First Cutting

	Stable Compost	Fertilizer 4-8-4	Muriate of Potash	Check	Nitrate of Soda	Lime (Dolomitic)
Date of Harvest	10 tons	400 pounds	100 pounds	No Treatment	150 pounds	1500 pounds
First Cutting 6-11, 1935	1.55	1.68	1.50	1.83	2.00	1.30
Second Cutting 8-22, 1934	4.13	2.88	2.88	2.75	3.63	2.50

Two acres or more under various fertilizer treatments (stable compost, 4-8-4, nitrate of soda, muriate of potash, and lime) have been under observation here for several years. So far the plants respond more to stable compost than any of the other treatments: Moisture seems to be a more important factor than fertilization.

References: South Carolina Agricultural Experiment Station Forty-eighth Annual Report, page 138, table 42, December 1935, Clemson, South Carolina. South Carolina Agricultural Experiment Station Fiftieth Annual Report, page 143, December 1937, Clemson, South Carolina.

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[*] Used here with their permission

Hay Crops

Kudzu is being used considerably at the present time as a hay crop. In most cases the fields were set to Kudzu because they were severely eroded and no longer of value for cultivation purposes. During the past four years the Soil Conservation Service has established vast numbers of kudzu crowns upon severely eroded hill sides. Those areas which have been properly fertilized and cultivated were cut for hay in the third or fourth year. Some plantings made on more fertile soils were cut the second year. Table No. 3 shows that kudzu hay compared very favorably with alfalfa, soybeans or cowpea hay in total digestible nutrients. It is highest in phosphorus, and with the exception of cowpea hay, it is highest in nitrogen content. This is shown in Table No. 2.

Table VI—Yields of Kudzu at Auburn

Year	Number of Cuttings	Date of Cutting	Yield of Hay Per Acre
			Lbs.
1920	1	September 10	5,114
1921	2	July 28—September 2	5,410
1922	2	August 4—September 23	5,240
1923	2	August 2—October 10	5,665
1924	2	July 29—October 10	4,722
1925*	2	July 8—August 10	3,100
Average			4,875

*The low yield in 1925 was due to the fact that during the period from February to August, inclusive, the rainfall was 20.57 inches below normal.

Reference: Alabama Agricultural Experiment Station Circular 57, Kudzu in Alabama, page 4, table 2, January 1931, Auburn, Alabama.

It is of particular interest that the crop not only yields good hay, but the total yields are also quite good. A six year average yield is shown in Table No. 6.

From the standpoint of both production and saving hay, kudzu has another distinct advantage over most other legumes used for hay. It does not have to be cut at a specific time. Its leaves are retained well, and it cures quickly even when cutting is delayed for three or four weeks. This is very helpful in avoiding peak loads of labor or periods of bad weather.

It must be recognized, however, that there are two undesirable features that will be encountered in using Kudzu for hay. The matted effect of the vines which lay closely to the soil and are securely fastened to it by roots at the nodes make it difficult to cut. Many of the vines are not cut and for that reason raking must be done by hand. The cutting problem has been solved by the Alabama Experiment Station. They have made a small apparatus that is attached to the end of the mower blade. This apparatus is shown in Figure 8, and is easily made and attached. When this attachment is used, no difficulties have been experienced in cutting kudzu.

Table VII—Effect of Frequency of Cutting on Yield

Cutting Treatment Each Year	Yield—Pounds Hay Per Acre	
	1933	1934
Cut one time	2,800	6,720
Cut twice	7,106	8,565
Cut three times (Last cutting made just before frost)	8,980	8,970
Cut three times when ready	8,895	7,725

This kudzu was planted in 1930 on what is known as the Monroeville Field.

Reference: Alabama Agricultural Experiment Station Mimeograph, "Kudzu", Auburn, Alabama.

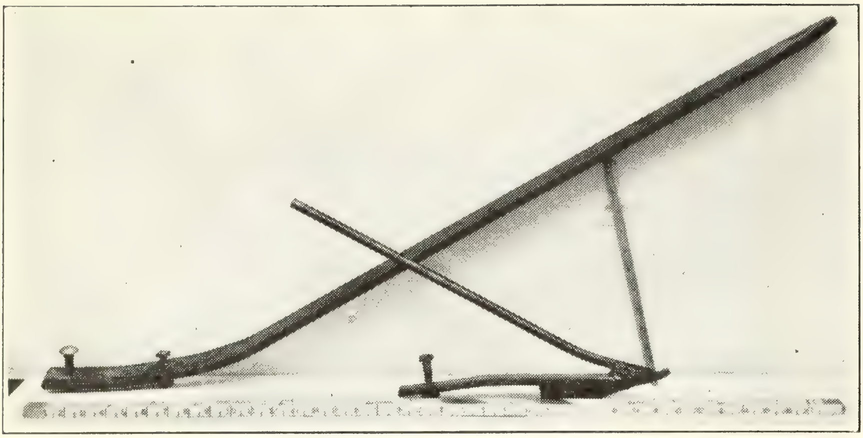

Figure 8. The mower attachment used in cutting kudzu for hay. The long flat bar is substituted for the slide at the end of the cutter bar with bar extending upward and forward. The smaller device fits over the fifth guard.

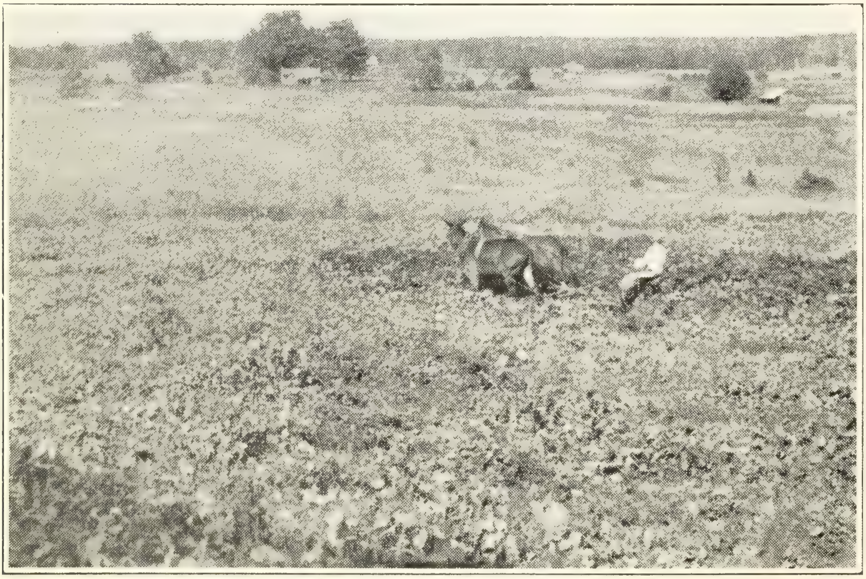

Figure 9. Cutting kudzu hay.

Table VIII—Effect of Time and Frequency of Cutting on Yield of Hay

Plot	Cuttings	Date of Cutting	Pounds of Hay Per Acre			
			1928	1929	1930	Average
1	2 early	June 1, August 15	5,749	4,333	1,815	3,966
2	2 late	June 1, October 15	5,374	4,077	2,595	4,015
3	3 early	May 1, July 1, August 15	4,256	2,834	1,515	2,868
4	3 late	May 1, July 1, October 15	3,570	4,300	2,366	3,412
5	4 early	May 1, June 1, July 1 August 15	3,406	2,944	851	2,400
6	5 late	May 1, June 1, July 1 August 15, October 15	3,830	2,829	1,205	2,618

This test was on Norfolk sandy loam at Auburn, Alabama. The plants were put out in the spring of 1926 and mowing started in 1928.

Reference: Alabama Agricultural Experiment Station Circular 57, Kudzu in Alabama, page 6, table 3, January 1931, Auburn, Alabama.

Vegetating Water Disposal Areas from Terraces

Kudzu has been used in vegetating the waterways into which terraces empty. In view of the fact that it requires some time for the crop to become well established, it perhaps would be well to provide some other temporary protection until the plant has had time to establish itself or to set the plants prior to the time the area will be used as an outlet ditch. This should not require more than one season. The effectiveness of the plant for this purpose is shown in Figure No. 10. The objection might be raised that such a dense coverage would cause silting of the outlet ditch which would soon result in the ditch being higher than the field outside of the ditch. This, however, does not seem to be a serious criticism because it can be remedied by simply plowing the ditch out with a turning plow, a Martin ditcher or a small road grader. In using a plow for this purpose it will be advisable to attach a rolling coulter to cut the vines ahead of the plow point.

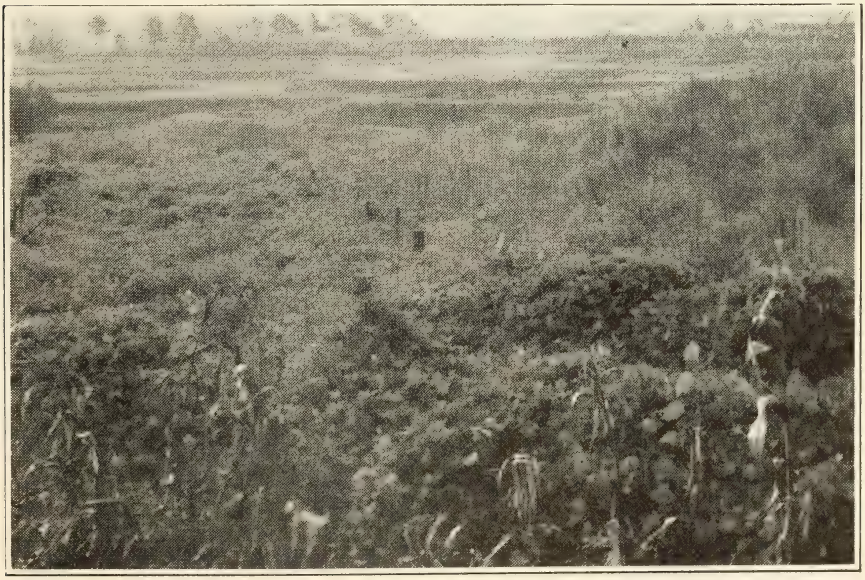

Figure 10. Outlet ditches may be vegetated very effectively with kudzu. This is an outlet ditch in which kudzu is doing well in Ruston fine sandy loam. Kudzu was planted in 1935. Picture was made in September 1938.

Road Bank Protection

The crop has also been used some, and seems to have very good possibilities, as a plant to protect cuts along the highway. Enormous quantities of grass sod have been put out on many of the deep cuts and were doomed to failure from the beginning. Seed bed preparation, proper varieties, mulching and fertilizers are all very important factors in establishing vegetation upon these areas. Kudzu, however, seems to have a very good advantage over many plants in that the central plant can be localized in a small area of relatively fertile soil and the runners from this central plant cover a large area of relatively infertile soil. Kudzu is doing an effective piece of work in protecting road banks in figure 11. This particular area had previously been sodded twice.

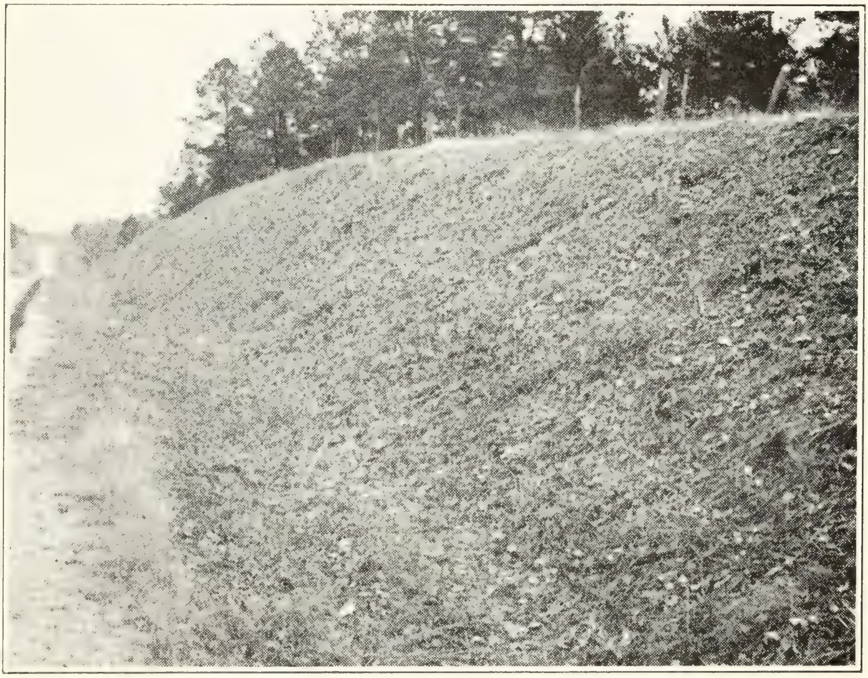

Figure 11. Protection given by kudzu in the winter.

Kudzu As A Pest

There has been an idea abroad that when kudzu is once started, it spreads and covers the place and can not be killed. It is true that it is an aggressive plant, but this station keeps it confined to individual plots without any serious trouble. It is easily killed by grazing or frequent and thorough plowing.

The foregoing statement concerning the uses and advantages of kudzu are not made to imply that the plant is the utopia of our dreams. In fact, there are many places in which it can not possibly succeed, even if precaution is taken as to propagation, cultivation and fertilization of the crop. It is true that it is capable of good growth on a wide variation in soils. There have been many failures, however, in attempting to establish the plant in the field. Since the crowns are quite* expensive, these failures are very harmful.

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*From $8.00 to $10.00 per thousand for two year crowns on the basis of 1938 prices.

There should be very few failures with the crop if the following precautions and recommendations are followed:

1. Do not plant on poorly drained soils.

2. Prepare the seed bed as thoroughly as for corn; and long enough before setting the crown for the soil to permit the bed to settle.

3. Fertilize according to the needs of the land. Kudzu responds well to complete fertilizers, and especially to phosphorus on non-productive lands. (Note table No. 5).

4. Cultivate the crop until it is established. In no case should cultivation cease in less than one growing season. Where the plant is used for gully control, it should likewise be kept free from competitive plants. This may best be done with a hoe.

5. Buy good strong, preferably two year old, crowns for the initial stock. Require that the crowns be delivered immediately after removal from the soil and without being subjected to severe temperatures or extreme drouth conditions in route.

6. Upon receipt of the crowns, set them immediately, leaving the buds flush with the surface of the previously fertilized and settled soil. Care must be exercised to see that the bud end of the crown is placed up. Sometimes the lower end of the crown is larger than the bud end. A dibble, or a tile shovel or mattock or anything that will penetrate the soil easily and deeply and leave it open when withdrawn may be used to open a place to set the crown. It should be deep enough and wide enough to place the crown in an upright position without folding or bending the roots. After the crown is placed in the hole, it should have the soil compacted firmly against it.

7. The number of crowns to plant per acre depends upon the fertility of the soil and how quick a complete coverage is desired. Usually about 1,000 is sufficient. If planted on ten foot rows and the crown set four and one-half feet apart in the drill, approximately 1,000 crowns will be planted to an acre. There will be sufficient space for two 40'' rows between each row of kudzu which may be used for corn or whatever is desired.

8. The most economic method of establishing kudzu on a large area is to buy sufficient crowns to set one or two acres, and later use this area to secure crowns to set the remainder of the area. If this policy is followed, care should be exercised to prohibit wounding or damaging the crowns while digging or plowing them up. Only the strong vigorous crowns should be set. As soon as the crowns are dug they should be wet and puddled in very fine soil, preferably from a kudzu field, so as to protect it from drying and at the same time provide inoculation. In most instances perhaps the soil will already be inoculated but this method insures inoculation. After puddling, the crowns should be covered to protect them from drying and set as soon as possible. The best date of setting is the latter half of February through the 1st half of March. Kudzu is sometimes established by planting the seed. When this method is used the seed should be well scarified, soaked in water over night and inoculated before planting. The seed may be planted in a bed and later reset in the field or they may be

planted directly in the field. In either case they should not be planted until April or May when the soil has warmed up. The seed supply is relatively small and therefore crowns are used most.

The crop has great possibilities BUT GOOD SEED OR SEED STOCK, MUST BE PROPERLY PLANTED, CULTIVATED, AND FERTILIZED until established in order to succeed, just as is true of any other crop.

Bulletin No. 327 April, 1939

Growing Sweetpotatoes

In the Yazoo-Mississippi Delta

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Summary and Recommendations

1. A light, well drained, sandy loam or loam soil with a clay subsoil is best for growing sweetpotatoes in the Yazoo-Mississippi Delta.

2. Experiments reported in this bulletin indicate that nitrogen gives an economical increase in the yield of sweetpotaoes. Applications of potash and phosphorus, or of a complete fertilizer proved to be unprofitable.

3. Best yields may be expected from the Porto Rico variety. It also has good table quality and keeps well while in storage.

4. On the average farm, a manure heated bed for the production of plants is all that is necessary, though satisfactory flue heated hotbeds may be constructed at negligible cost. About eight bushels of seed potatoes are required to produce enough plants to set an acre.

5. It is recommended that plantings be made on beds in rows 36" wide and that the plants be spaced 12" apart in the drill. Plantings with these spacings will require about 14,500 plants per acre.

6. Only enough cultivations to keep the soil free of grass and weeds are necessary.

7. Sweetpotatoes must be harvested and handled in such a way as to avoid bruising. Grading in the field is best, since they should be handled as little as possible.

8. The potatoes should be placed in a curing house within a few hours after they are dug and kept for ten days at a temperature from 80° to 85°F and a relative humidity of 90 per cent. The temperature of the storage house should then be gradually reduced and maintained as near 55° as possible throughout the storage period.

9. Sweetpotatoes should be so produced as to be relatively free of all diseases which cause losses in field and storage.

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Growing Sweetpotatoes
In the Yazoo-Mississippi Delta

By E. A. CURREY, Horticulturist
Delta Branch Experiment Station
Stoneville, Miss.

The sweetpotato is one of the principal vegetable foods of the people in the Yazoo-Mississippi Delta. Since it is the general opinion that good yields of high quality sweetpotatoes can not be produced in this alluvial valley, a large portion of the sweetpotatoes consumed are brought in from other areas. Results of experiments at this Station show that high yields of sweetpotatoes can be obtained on the lighter Delta soils, and that the quality of a properly grown and handled crop is good.

Factors affecting the yield and quality of sweetpotatoes are soil type and drainage, soil fertility, variety, and cultural methods. The keeping quality is affected to a very great extent by the time and methods of harvesting, by the effectiveness of safeguards against disease throughout the period of growing, harvesting and storage, and by the methods used in curing and storage.

A combination of conditions favorable to the production of clean stock and the proper handling of such stock through thd period of curing and storage, ought to result in as successful a crop of sweetpotatoes in the Delta as elsewhere, either for home consumption or for marketing.

The several factors affecting the production as well as the eating and keeping qualities of sweetpotatoes are briefly discussed in this bulletin. The results of eight year's studies of fertilizers, varieties, curing, and storage at the Delta Branch Experiment Station are presented in support of conclusions reached and recommendations made.

Soils For Sweetpotatoes

Earlier tests showed that the lighter soils were more adapted to sweetpotatoes than were the heavier soils. A light, well drained, sandy loam or loam with clay sub-soil is an ideal soil for sweetpotatoes in the Delta as elsewhere, though they can be grown on others. A moderate amount of organic matter in the soil seems essential for best results. Very fertile soils are not the most desirable for growing table quality sweetpotatoes because on such soils the plant may make excess vine growth and stringy, poor quality roots. The roots are likely to be rough and irregular in shape, too large in size, and the skin will probably be cracked. It is never advisable to plant sweetpotatoes on a poorly drained soil, and if conditions are such that a poorly drained soil must be used, it is important that planting be done on high ridges to insure ample local drainage.

The Effect of Fertilizer

During the eight years, 1930-1937 inclusive, an extensive study was made of the responses of sweetpotatoes under Delta conditions to applications of nitrogen, phosphorus, and potash, and of their various combinations.

These tests were conducted on what is locally known as Deer Creek loam soil that had been planted to cotton for approximately thirty years without rotation or legumes. Fertilizer was applied at the rates per acre of 241 pounds of ammonium sulphate, 241 pounds of super-phosphate, and 241 pounds of 20% kainit. Unfertilized plots were used as checks. Five-row plots containing 1-10 acres were used, but weights were taken from the three middle rows only. There were four replications of each treatment.

The production record of all plots receiving the different fertilizer treatments from 1930 through 1937 is summarized in table 1. The grades of sweetpotatoes produced, including the percentage of No. 1's, strings, and jumbos, are also shown in table 1. The effect of fertilizer treatments upon shrinkage in curing and storing is indicated in table 2.

Highest Increase From Complete Fertilizer

As shown in table 1, the highest yield of sweetpotatoes over the eight-year period was secured from the plot receiving complete fertilizer; the increase over the no fertilizer plot being 102.3 bushels per acre.

The striking influence of nitrogen was shown in plots receiving incomplete fertilization. The second highest yield was secured from plots fertilized with nitrogen only, the increase being 83.2 bushels per acre. Plots receiving nitrogen and potash showed an average increase of 81.5 bushels per acre. Plots fertilized with nitrogen and phosphorus showed an increase of 75.2 bushels per acre. When nitrogen was omitted from the fertilizer application, there was a decided decrease. Plots receiving phosphorus and potash produced 23.7 bushels per acre more than the unfertilized plots, while on plots fertilized with phosphorus only the increase in yield over the unfertilized plots was 21.2 bushels per acre.

Nitrogen Only Most Economical

To produce the complete fertilization increase of 102.3 bushels over the unfertilized plot, required 241 pounds ammonium sulphate, 241 pounds of superphosphate, and 241 pounds of 20% kainit. The 83.2 bushel increase from nitrogen fertilization required the application of 241 pounds of ammonium sulphate only. The difference between the increase from nitrogen alone and from complete fertilizer, amounting to 19.1 bushels per acre, was therefore secured at the cost of 241 pounds of superphosphate, and 241 pounds of 20% kainit.

These data show that nitrogen only gives economical increase in the yields of sweetpotatoes. This element should be applied at the rate of 20 to 40 pounds of nitrogen per acre, obtainable from 125 to 250 pounds of nitrogen fertilizer material, the quantity depending upon the kind of material used. Fertilizer should be applied under the rows at the time the land is bedded in the spring, and preferably two weeks or more before the plants are set. This recommendation applies to average Delta loamy soils.

Fertilization Improves Grade

Sweetpotatoes are produced generally in Mississippi and exclusively in the Delta for table stock; and under these conditions, grade has an important bearing upon the commercial value of the crop produced. Table 1 is of interest and importance because it shows that fertilizer practices for the most economical production of large yields of sweet-

TABLE 1—INFLUENCE OF FERTILIZATION ON TOTAL YIELD AND GRADES OF SWEETPOTATOES

Treatment	Total Yield (55 lb. bu.) Average 1930-1937	Average Increase over no Fertilizer	Yield No. 1's Ave. 1930-37 (55 lb. bu.)	Per cent Total Yield in Grades Shown		
				No. 1	Strings	Jumbo
Complete Fertilizer	345.6	102.3	247	71.4	14.6	13.0
No Fertilizer	243.3	....	163	67.0	28.4	3.7
Nitrogen and phosphorus	318.5	75.2	230	72.1	15.3	11.3
Nitrogen and Potash	324.8	81.5	238	73.3	15.7	10.2
Phosphorus and Potash	267.0	23.7	186	69.7	25.6	3.4
Nitrogen	326.5	83.2	241	73.7	15.7	9.7
Phosphorus	264.5	21.2	186	70.2	24.6	4.3

potatoes are also conducive to the production of maximum quantities of marketable grades of sweetpotatoes and of minimum quantities of undesirable or unmarketable grades.

During the eight-year period of testing, the lowest percentage and the lowest number of bushels of No. 1 sweetpotatoes was harvested from the unfertilized plot. The largest number of bushels and the fourth highest percentage of No. 1 were complete fertilizer plot. The highest percentage of No. 1 sweetpotatoes was secured from the plot fertilized with nitrogen only, and the total production of No. 1 sweetpotatoes harvested was only 6 bushels less than from the complete fertilizer plot; it was 3 more bushels of No. 1's than was harvested from the nitrogen and potash plots; 11 more bushels of No. 1's than from the nitrogen and phosphorus plots; 55 more bushels of No. 1's than from the phosphorus and potash plots and from the phosphorus plots; and 78 more bushels of No. 1's than from the no fertilizer plot.

Strings and Jumbos

The percentage production of strings was low and uniform on all fertilized plots when nitrogen was included whether alone or in conjunction with phosphorus or potash or both. The proportion of strings from all plots receiving nitrogen ranged from 14.6% to 15.7%. The proportion of strings from the no fertilizer plot was 28.4%; from the phosporus and potash plot 25.6%; and from the phosphorus plot 24.6%.

The yield record of jumbos seems to indicate that just as the improperly nourished plants produce excessive quantities of strings, so do the properly nourished plants produce potatoes of large size. The highest percentage of jumbos, 13%, was harvested from the complete fertilizer plot; this treatment also produced the highest total yield as well as the highest yield of No. 1's. Other fertilizer treatments which, as previously recited, produced highest yields of all grades, highest yields of No. 1's, and lowest yields of strings similarly resulted in considerable production of jumbos. The percentages of jumbos were: 11.3% for nitrogen and phosphorus, 10.2% for nitrogen and potash, and 9.7% for nitrogen alone. Plots not fertilized or fertilized with mixtures containing no nitrogen—which, as previously recited, produced lowest total yields, lowest yields of No. 1's and highest yields of strings—similarly produced lowest percentages of jumbos. The percentage of jumbos from the no fertilizer plots was 3.7%, from the phosphorus and potash plots 3.4%, and from the phosphorus only plots 4.3%.

No Effect On Shrinkage

During five years, 1931-1936 inclusive weighings were made at intervals and records were kept of successive weights of identical packages to determine the effect of the various fertilizer treatments upon shrinkage. The question is important because most sweetpotatoes produced in Mississippi are cured and stored and afterwards sold on the basis of weight, so that often whatever weight is lost through shrinkage is lost in market value. The data in table 2 show shrinkage of sweetpotatoes produced under the several fertilizer treatments. These data do not

TABLE 2—INFLUENCE OF FERTILIZATION ON SWEETPOTATO SHRINKAGE DURING CURING AND STORAGE

Treatment	1930 1931	1932 1933	1933 1934	1934 1935	1935 1936	5-Year Average
	Per Cent Shrinkage During Curing and Storage					
Complete Fertilizer	8.4	11.9	14.0	9.3	11.5	11.0
No Fertilizer	9.3	13.2	12.0	10.8	11.6	11.4
Nitrogen and Phosphorus	9.3	13.2	14.7	10.6	11.6	11.9
Nitrogen and Potash	8.3	13.5	16.2	10.0	11.6	11.9
Phosphorus and Potash	9.1	10.3	11.4	11.9	11.8	10.9
Nitrogen	8.5	11.7	15.6	9.1	11.5	11.3
Phosphorus	9.5	11.8	12.4	11.4	11.5	11.3

reveal any worthwhile differences in shrinkage during the curing and storage period or keeping qualities of sweetpotatoes attributable to the fertilizer treatments.

Varieties of Sweetpotatoes

The numerous varieties of sweetpotatoes vary considerably in yield, table qualities, content of starch, resistance to disease and storage rots, and shrinkage during storage. To determine the variety or varieties best suited to Mississippi conditions, several of the leading varieties were tested and their characteristics observed. The variety tests were uniformly fertilized, cultivated, and handled so that reliable comparisons might be made.

Porto Ricos Led All Others

The Porto Rico, widely planted because of its production, cooking, and keeping qualities, led all other varieties in the Delta test in yields. During the eight years, 1931-1938 inclusive, Porto Rico produced an average of 320.9 bushels per acre.

Triumph, with poor table qualities and mostly produced in Mississippi for starch manufacture, was second in production with an eight-year average of 293.2 bushels per acre. Nancy Hall, a favorite in Mississippi until recent years, produced an average of 200.6 bushels per acre and ranks second in production among the desirable table varieties. Gold Coin produced an average of 287.8 bushels per acre but is considered poorer in quality than Porto Rico and Nancy Hall. Southern Queen, locally referred to as "Negro Choker", produced an average of 211.9 bushels per acre but ranks lowest in table quality of all varieties tested. It is very susceptible to black rot and is a poor keeper. Yellow Yam produced an average of 187.6 bushels per acre during a six year period, at the end of which it was dropped from the test for cause. This variety ranks very high in table quality but is low in production of No. 1 roots, and shrinkage during curing and storing is very high.

Yellow Jersey, Big Stem Jersey, Gold Skin, and Vineland Bush varieties were included in the tests in the beginning. Yellow Jersey has been retained because, though it produced an average of only 168.4 bushls per acre during the eight year period, it appears promising for table use. The Big Stem Jersey, Gold Skin, and Vineland Bush varieties were dropped from the test in 1935 because of low yields or poor quality or both.

Desirable Grades of Sweetpotatoes

A study of the sweetpotato variety data by grades reveals additional phases of Porto Rico superiority. Of the five varieties tested through the eight year period, the percentages of sweetpotatoes grading No. 1 was remarkably uniform, and were as follows: Nancy Hall 72.1%; Porto Rico 72.7%; Triumph 72.2%; Southern Queen 71.0%; Yellow Jersey 67.0%. The average yield in bushels of No. 1 sweetpotatoes varied quite widely, however, being 233.3 bushels for Porto Rico, 144.6 bushels for Nancy Hall, 211.7 bushels for Triumph, 150.4 bushels for Southern Queen, and 112.8 bushels for Yellow Jersey.

Minimum production of strings is de-

TABLE 3—VARIETIES OF SWEETPOTATOES; TOTAL YIELDS AND YIELDS IN GRADES SHOWN

	Total Yield (55 lb. bu.) per acre		No. 1 Yield	Per Cent Total Yield In Grade Shown		
Variety	8-Year Average	Comparison With Porto Rico	per acre	No. 1	Strings	Jumbo
Porto Rico	320.9	....	233.3	72.7	15.6	10.5
Nancy Hall	200.6	—120.3	144.6	72.1	25.5	1.2
Triumph	293.2	— 27.7	211.7	72.2	22.4	3.8
Gold Coin*	287.8	— 33.1	180.2	62.6	20.3	15.3
Southern Queen	211.9	—109.0	150.4	71.0	17.0	11.0
Yellow Yam*	187.6	—133.3	127.8	68.0	30.4	0.0
Yellow Jersey	168.4	—152.5	112.8	67.0	32.7	0.0

*Six-Year Average—dropped in 1936.

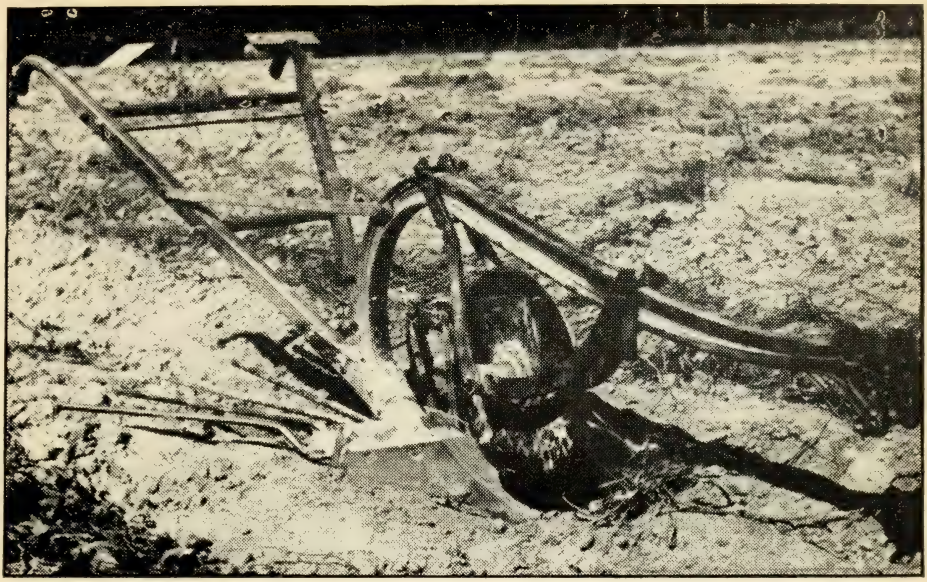

FIGURE 1—TWO-HORSE SWEETPOTATO DIGGER CONVERTED FROM 14-INCH MIDDLE BUSTER

The sweetpotato digger illustrated above was developed by the Agricultural Engineering Department of the Mississippi Experiment Station, and was thoroughly tried out under field conditions in the Laurel area last year. It will turn out seven acres to eight acres of sweetpotatoes per day. The conversion may be made from any middle buster, preferably the 14-inch size, at a cost of $7.50 to $10.00. For eating stock, where cut potatoes are objectionable, it is recommended that 2 disk hillers be used instead of the rolling coulter.

sirable, whatever the purpose for which sweetpotatoes are used. In the production of strings, Yellow Jersey was highest with 32.7%; Nancy Hall, second, with 25.5%; Triumph third, with 22.4%; Southern Queen, fourth, with 17.0%; and Porto Rico, lowest, with 15.6%. In the production of jumbos, none were produced by Yellow Jersey in any of the eight years, followed in order by an eight year average of 1.2% for Nancy Hall, 3.8% for Triumph. 10.5% for Porto Rico, and 11.0% for Southern Queen.

Of seven varieties tested during the five year period 1931-1936, Porto Rico was lowest in per cent of shrinkage. though the difference was small in the instances of five of the seven varieties tested. Porto Rico shrinkage during curing and storage was 15.7%, Gold Coin 16.2%, Triumph 16.9%, Southern Queen 16.9%, Nancy Hall 17.8%. Shrinkage of Yellow Yam during curing and storage was 21.3% and of Yellow Jersey 20.0%.

Varieties for Starch Manufacture

There has recently developed quite a bit of interest in the Delta in the commercial production of sweetpotatoes for starch, though none has been produced for that purpose in the Delta to date. The record of Triumph, as shown in the foregoing tables, is of interest because it is the variety produced for starch manufacturing purposes in the Laurel area. On account of the recent interest in sweetpotato production for starch, new variety studies were begun in 1937 and are being continued and enlarged. Many new varieties heretofore untried in the Delta have been introduced or originated by the United States Department of Agriculture, and are included in these studies because of their possibilities as high producers or because of their high starch content. One or more of these, which are as yet unnamed, show considerable promise.

No attempt was made to correlate production by grades as affected by fer-

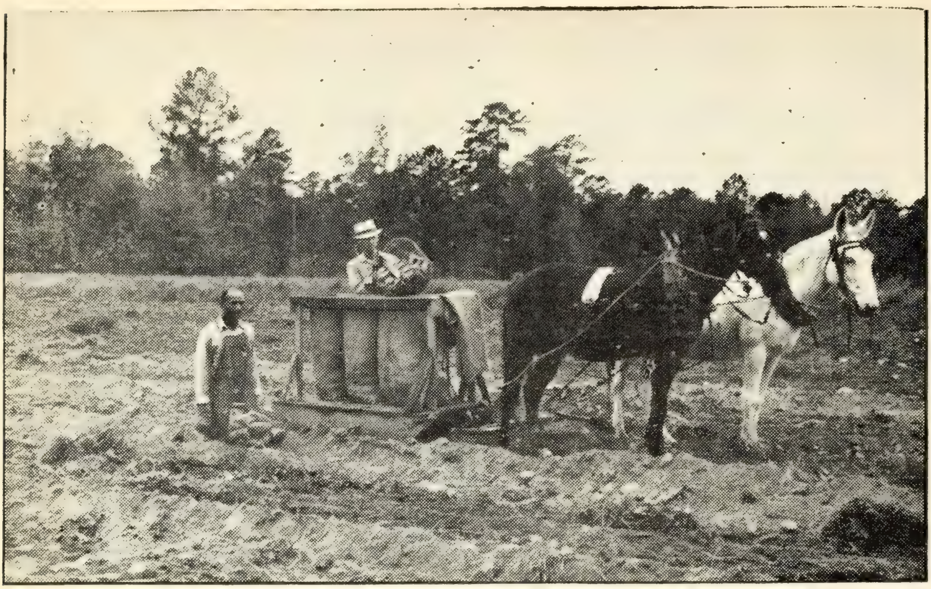

FIGURE 2—A NEW USE FOR THE FAMILIAR "SLIDE" IN ASSEMBLING, GRADING, AND PACKAGING

The slide was adapted for use by Lee Graves, Jones County sweetpotato grower, in cooperation with Experiment Station. The converted slide, used alternately with the digger by Mr. Graves and his negro helper and team as pictured above, turned out, picked up, bagged, and loaded on trucks, 5 tons of sweetpotatoes per day. For eating stock it is recommended that the slide be equipped with crates or hampers so that the sweetpotatoes may be graded and placed in containers as picked up in the field and carried to market or storage house without any further handling.

tilizer treatment and variety. It seems significant, however, that while the use of nitrogen only was found most profitable when cost, grade and total production are considered, the Porto Rico variety under the same fertilizer treatment led all other varieties when total production and desirable grades are considered.

Planting and Cultivation

Because of other experimental work under way in the growing of sweetpotato plants, this phase of sweetpotato production was not undertaken in the studies here reported. Results of work by the central station have recently been published, and the grower is referred to Mississippi Experiment Station Bulletin No. 325 for detailed information about building beds and the growing of sweetpotato plants. A copy can be had by writing the Mississippi Agricultural Experiment Station, State College, Mississippi.

The inexpensive, flue heated hot beds, described and illustrated in Station Bulletin No. 325, are intended for the use of commercial growers to produce plants for two acres or more. Sweetpotato plants may be purchased for large scale or small scale production. The grower who desires to produce sweetpotatoes in small quantities, largely for use in his own home, may find the manure heated hot beds satisfactory, or in the event delayed planting is not objectionable, the use of beds without any facilities for heating may be found satisfactory.

Time of Planting

Yields of sweetpotatoes reported in this Bulletin were secured from plantings made about April 15 to May 1st. Numerous experiments have shown the necessity for early planting if maximum yields are to be secured. Experiments by the United States Department of Agriculture in South Carolina have shown

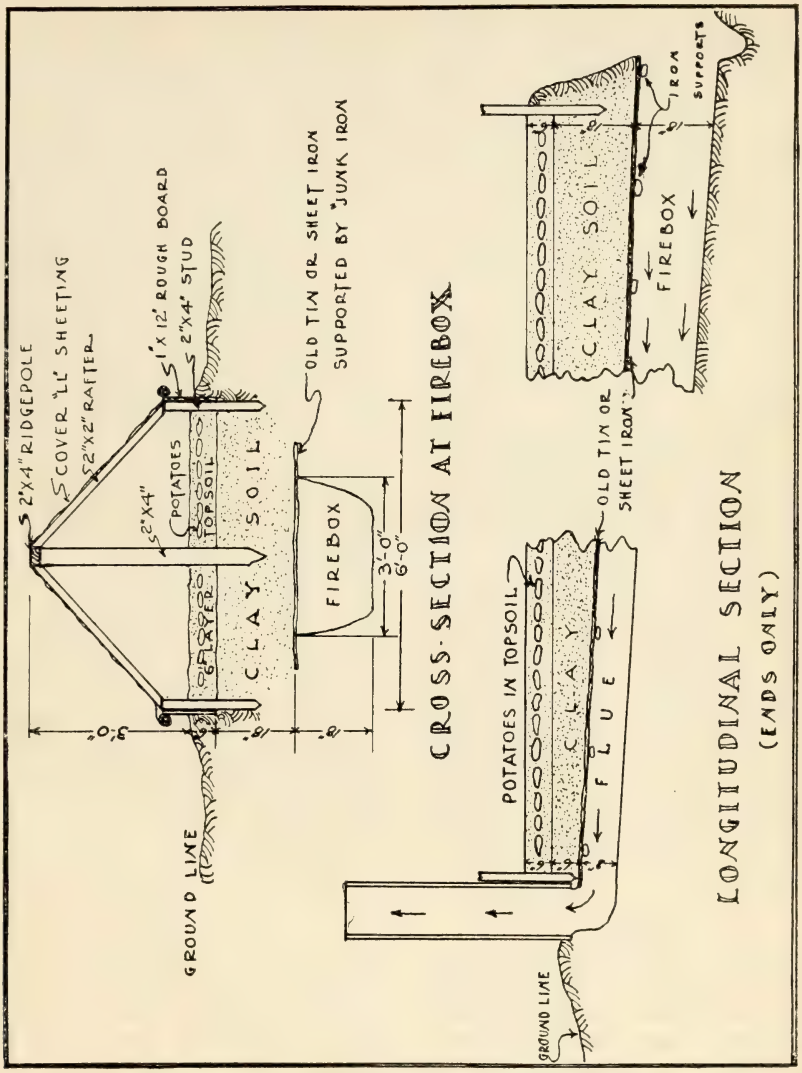
2"X4" RIDGEPOLE
COVER "LL" SHEETING
2"X2" RAFTER
1"X 12" ROUGH BOARD
2"X4" STUD
OLD TIN OR SHEET IRON SUPPORTED BY "JUNK IRON
2"X4"
POTATOES
TOPSOIL
6" LAYER
CLAY SOIL
FIREBOX
3'-0"
6'-0"
3'-0"
18"
18"
GROUND LINE
CROSS-SECTION AT FIREBOX
POTATOES IN TOPSOIL
CLAY
FLUE
OLD TIN OR SHEET IRON
IRON SUPPORTS
FIREBOX
CLAY SOIL
18"
18"
GROUND LINE
LONGITUDINAL SECTION
(ENDS ONLY)

FIGURE 3—SINGLE DITCH FLUE HOTBED

The flue of this bed consists simply of a ditch, 3 feet wide with sides sloping to prevent caving, dug in the center of an excavated area the same width as the bed and 18 inches deep at the fire box end and 6 inches deep at the stack end. Junk iron may be used to cover 12 to 15 feet of the ditch at the fire end. Poles, slabs, boards or anything convenient that will carry the weight of the soil may be used to cover the remaining part of the ditch. Four 12-inch boards nailed together form the smoke stack, and compacted clay soil is best for covering over the flue. This bed should not be longer than 50 feet nor wider than 6 feet, and should be built on a slope with the stack at the higher end or a drainage ditch provided at the fire box end.

that each week's delay in setting out Porto Rico sweetpotatoes from May 15 to July 15 means a reduction of 25 bushels per acre in total yield, including a reduction of 15 bushels in No. 1 yield. Many other experiments have shown that early planting is necessary if highest total yields are expected, notably including those of the Mississippi Station in the sweetpotato starch producing area at Laurel.

Setting The Plants

About 14,500 plants are required to set an acre if spaced 12 inches apart in rows three feet wide. The plants should not be removed from the bed before the stems are strong and the roots are well developed. If possible they should be set out immediately after a rain. While pulling the plants, if the roots are plunged into wet sawdust or fine straw and the tub or other container covered with wet burlap, the plants will keep perfectly.

It is important that the roots be well covered when planted, with the soil packed around them from bottom to top. If the soil does not contain an abundant supply of moisture, watering is advised. In any event, a small depression should be left at the surface of the soil so the plants can be watered later if necessary. Best yields have been obtained under Delta conditions by planting on higher-than-average beds in rows 36 inches apart and 12 inches in the drill.

Cultivation

Methods of cultivating sweetpotatoes do not differ materially from those employed with ordinary farm and garden crops. Roots should not be disturbed Clean tillage is important, as the competition for plant food and water by weeds and grass naturally affects the growth of young plants. Loose soil in the middles should be worked toward the drill until a broad flat ridge is formed. Two hoeings and three or four cultivations are generally necessary, and when the vines grow sufficiently to interfere with the cultivation and the sweetpotatoes are free of grass and weeds, cultivation should be discontinued

Care In Harvesting

If sweetpotatoes are grown for the early market they may be harvested when the roots reach marketable size When they are grown for heavy yields, whether for eating or starch manufacture, they should be dug just before the first killing frost.

Every precaution should be taken to avoid bruising during harvesting. If the sweetpotatoes are to be stored, the skins should not be broken. It is desirable that the soil be comparatively dry at the time of harvesting because moist roots bruise easier than dry ones. Warm clear weather is best for harvesting the crop.

The Agricultural Engineering Department of the central station at State College has recently converted a middle buster into a very practical sweet-potato harvesting implement, which can be made from an ordinary middle buster on any farm where there is a competent blacksmith. A diagram and instructions for making the sweetpotato digger may be secured free by writing the Agricultural Engineering Department Mississippi Agricultural Experiment Station, State College, Mississippi. The sweetpotatoes should be picked up and placed directly into crates according to grade, and carried to the storage house or sold as soon as possible. They may be poured gently into the bins where they are to be cured and kept, or they may remain in baskets, crates, or boxes. It is best to handle them as little as possible. Grading in the field is recommended, in which event a painstaking overseer, who knows grades, is necessary.

Curing and Storage

For best results the sweetpotatoes require a warm moist atmosphere and a uniform temperature in curing. A limited quantity for home use may be placed in crates and cured near the kitchen stove or in a basement near

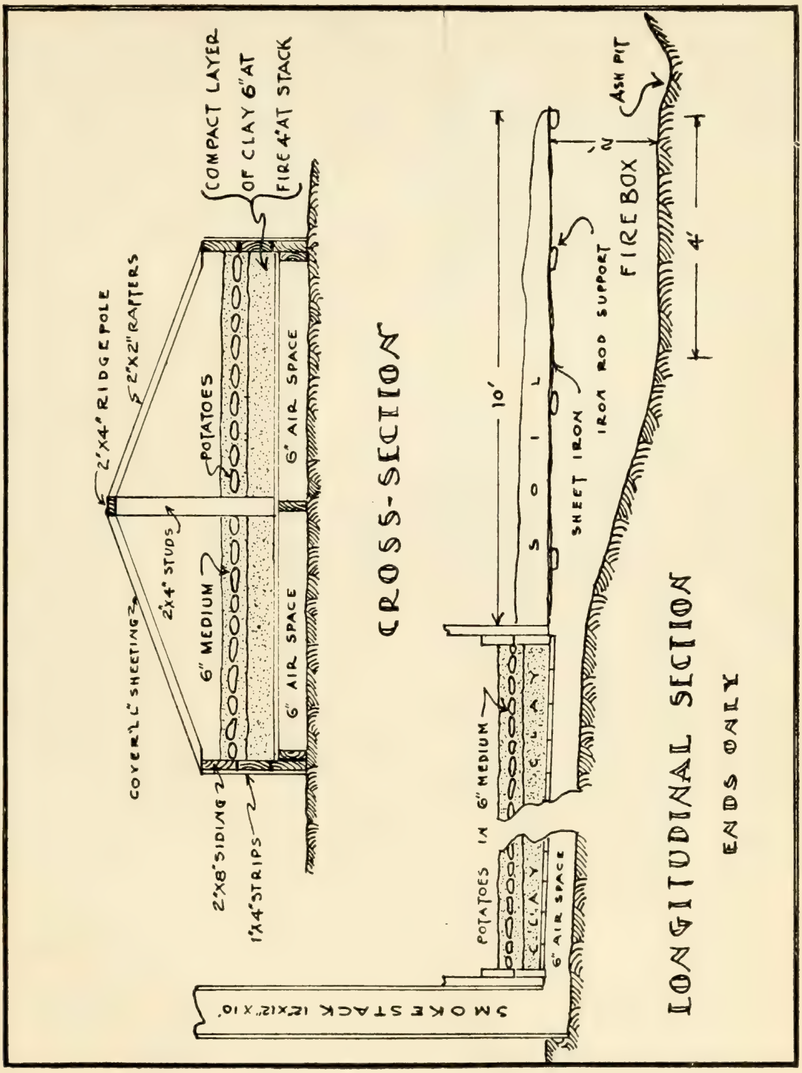
2"X4" RIDGE POLE
2"X2" RAFTERS
COMPACT LAYER OF CLAY 6" AT FIRE 4" AT STACK
POTATOES
6" AIR SPACE
6" AIR SPACE
2"X4" STUDS
6" MEDIUM
COVER "L.L" SHEETING
2"X8" SIDING
1"X4" STRIPS
CROSS-SECTION
10'
SOIL
SHEET IRON
IRON ROD SUPPORT
2'
ASH PIT
FIRE BOX
4'
POTATOES IN 6" MEDIUM
CLAY
CLAY
6" AIR SPACE
SMOKE STACK 12"X12"X10'
LONGITUDINAL SECTION
ENDS ONLY

FIGURE 4—FLUE HOTBED WITH FLUES ABOVE GROUND

Larger capacity, more uniform distribution of heat, and longer life are features of this bed. The fire should be 10 feet from the edge of the bed and the fire box should be 4 x 4 feet. The combustion chamber should be widened towards the bed so that smoke may enter the air space throughout the width of the bed. If made of good lumber, concrete, or brick, this bed would last almost indefinitely; and if made of 2-inch rough cheap lumber it should last at least 3 years without repairs. This type bed may be 10 or 12 feet wide but not longer than 50 feet.

a furnace. Where a large quantity is to be cured, a house of such construction as to permit control of temperature should be provided.

The object of curing sweetpotatoes is to heal wounds as quickly as possible. Experiments have shown that these wounds will heal most rapidly at a temperature ranging from 80° to 85° F. and a relative humidity of 90 per cent. Effective healing will take place in about 10 day's storage under these conditions. Therefore the temperature of the storage house should be kept at 80° to 85° and the relative humidity at about 90 per cent for a period of 10 days. Only enough ventilation should be given to prevent condensation of moisture. The old idea of curing was that by driving off a lot of moisture sweetpotatoes were protected against spoilage. The newer conception is to keep the potatoes in a moist atmosphere during curing so as to aid the healing process and to prevent excessive loss of moisture. Rapid and thorough healing will reduce Rhizopus soft rot, surface rot, Fusarium rot, Java black rot, and charcoal rot to a minimum and at the same time will reduce the loss of moisture during storage.

As soon as the curing period is over the temperature of the storage house should be reduced gradually (in about 2 days) to as near 55° as possible. This temperature should be maintained as nearly as practical, throughout the storage period. Temperatures below 50° should be avoided. Short exposure to temperatures between 32° and 50° may not result in injury, but prolonged exposure will lead to injury and decay.

A relative humidity ranging from 85 to 90 per cent should be maintained as far as practicable throughout the storage period. Such high humidities tend to check shriveling and internal breakdown and to further protect roots against infection.

The storage house should be well insulated and so constructed and managed as to avoid condensation of moisture on the roots and on the walls and roof of the storage house. Condensation of moisture on the roots or dripping from the roof tends to stain the roots and favors infection, especially by the black-rot fungus.

If the sweetpotato storage house is properly insulated and provided with proper vents in the floor and roof, condensation can be prevented if the ventilators are opened when the humidity of the storage house becomes too high.

Full information on the curing and storage of sweetpotatoes is conveyed in Leaflet No. 106, "Prevent Storage Rot in Sweetpotatoes", and Farmers' Bulletin 1442, "Storage of Sweetpotatoes". They may be had by writing the United States Department of Agriculture, Washington, D. C.

Disease and Certification

Sweetpotatoes should be so produced as to be relatively free of all diseases which cause losses in field and storage. Since sweetpotato diseases did not occur originally in Mississippi soils, there are still many farms on which they have not become established and which may remain free, if clean seed and plants are used. For nearly 20 years it has been unlawful in Mississippi to sell or give away seed sweetpotatoes or plants that have not been inspected or certified by the State Plant Board. Any grower who desires to qualify his crop for sale as certified seed or plants is required to file application with the Plant Board before June 15 of each year, since two or more inspections are made in the field. Further requirements are also made for the production of plants, including the approval of bedding locations and the disinfection of seed. Lists of certified growers may be secured from the Plant Board office at State College.

If new land is available for growing the crop, it is by all means preferred. If possible, sweetpotatoes should not be planted in soil which previously has produced a crop of diseased potatoes, since the disease organisms remain in the soil for many years, even though sweetpotatoes are not planted again on the same land.

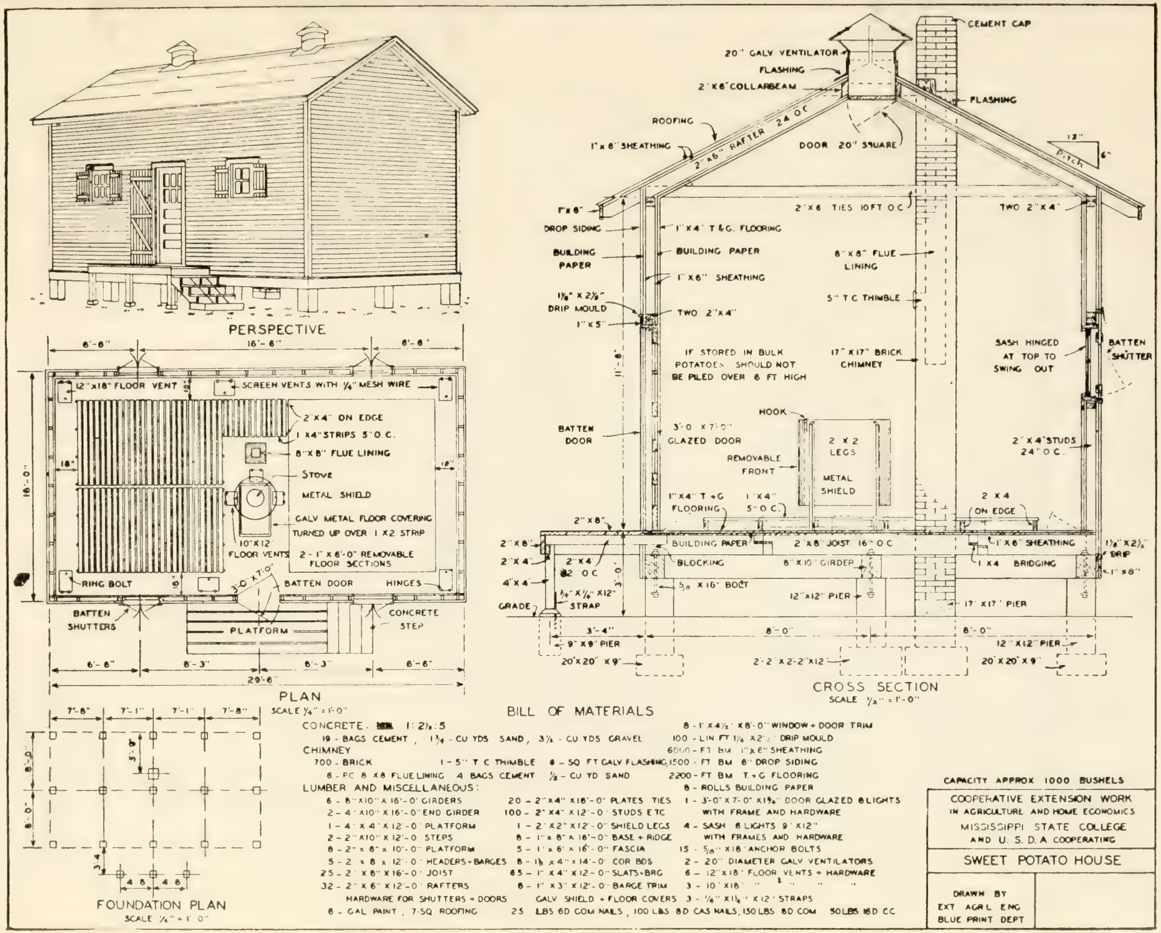
PERSPECTIVE
CEMENT CAP
20" GALV VENTILATOR
FLASHING
2"X8" COLLARBEAM
FLASHING
ROOFING
1"x8" SHEATHING
2"x6" RAFTER 24" OC
DOOR 20" SQUARE
12"
6"
Pitch
1"x6"
DROP SIDING
BUILDING PAPER
1½" x 2½" DRIP MOULD
1"x5"
2"x6" TIES 10FT OC
1"x4" T&G. FLOORING
BUILDING PAPER
1"x6" SHEATHING
TWO 2"x4"
8"x8" FLUE LINING
5" T C THIMBLE
TWO 2"x4"
SASH HINGED AT TOP TO SWING OUT
BATTEN SHUTTER
IF STORED IN BULK POTATOES SHOULD NOT BE PILED OVER 6 FT HIGH
17"x17" BRICK CHIMNEY
11'-6"
BATTEN DOOR
3'-0" x 7'-0" GLAZED DOOR
HOOK
2 x 2 LEGS
REMOVABLE FRONT
METAL SHIELD
2"x4" STUDS 24" O C.
1"x4" T+G FLOORING
1"x4" 5" O C.
2 x 4 ON EDGE
2"x8"
2"x8"
2"x4"
4"x4"
GRADE
2"x4" 32" OC
3'-0"
BUILDING PAPER
BLOCKING
⅝ x 16" BOLT
¾" x ¼" x 12" STRAP
2"x8" JOIST 16" O C
8"x10" GIRDER
12"x12" PIER
1"x6" SHEATHING
1 x 4 BRIDGING
17"x17" PIER
1⅛" x 2½" DRIP
1" x 8"
3'-4"
9"x9" PIER
20"x20" x 9"
8'-0"
2'-2" x 2'-2" x 12
8'-0"
12"x12" PIER
20"x20" x 9"
CROSS SECTION
SCALE ½" = 1'-0"
6'-6"
16'-6"
6'-6"
12"x18" FLOOR VENT
SCREEN VENTS WITH ¼" MESH WIRE
2"x4" ON EDGE
1 x 4" STRIPS 5" O.C.
8"x8" FLUE LINING
STOVE
METAL SHIELD
GALV METAL FLOOR COVERING TURNED UP OVER 1 X2 STRIP
10"x12" FLOOR VENTS
2 - 1" x 6'-0" REMOVABLE FLOOR SECTIONS
18"
18"
16'-0"
RING BOLT
3'-0" x 7'-0"
BATTEN DOOR
HINGES
BATTEN SHUTTERS
PLATFORM
CONCRETE STEP
6'-6"
8'-3"
8'-3"
6'-6"
29'-6"
PLAN
SCALE ¼" = 1'-0"
7'-8"
7'-1"
7'-1"
7'-8"
8'-0"
8'-0"
5'-6"
3'-4"
4 6
4 6
FOUNDATION PLAN
SCALE ⅛" = 1'-0"
BILL OF MATERIALS
CONCRETE 1:2½:5
19 - BAGS CEMENT, 1¾ - CU YDS SAND, 3½ - CU YDS GRAVEL
CHIMNEY
700 - BRICK 1 - 5" T C THIMBLE 8 - SQ FT GALV FLASHING
6 - PC 8 X8 FLUE LINING 4 BAGS CEMENT ½ - CU YD SAND
LUMBER AND MISCELLANEOUS:
6 - 8"x10" x 16'-0" GIRDERS
2 - 4"x10" x 16'-0" END GIRDER
1 - 4" x 4" x 12'-0" PLATFORM
2 - 2"x10" x 12'-0 STEPS
8 - 2" x 8" x 10'-0" PLATFORM
5 - 2" x 8 x 12'-0" HEADERS + BARGES
25 - 2" x 8" x 16'-0" JOIST
32 - 2" x 6" x 12'-0" RAFTERS
HARDWARE FOR SHUTTERS + DOORS
8 - GAL PAINT, 7-SQ ROOFING
20 - 2"x4" x 16'-0" PLATES TIES
100 - 2"x4" x 12'-0" STUDS ETC
1 - 2"x2" x 12'-0" SHIELD LEGS
8 - 1"x 8" x 16'-0" BASE + RIDGE
5 - 1" x 6" x 16'-0" FASCIA
8 - 1⅛ x 4" x 14'-0" COR BDS
65 - 1" x 4" x 12'-0" SLATS + BRG
8 - 1" x 3" x 12'-0" BARGE TRIM
GALV SHIELD + FLOOR COVERS
25 LBS 6D COM NAILS, 100 LBS 8D CAS NAILS, 150 LBS 8D COM 50 LBS 16D CC
8 - 1" x 4½" x 8'-0" WINDOW + DOOR TRIM
100 - LIN FT 1¼ x 2½" DRIP MOULD
6000 - FT BM 1" x 6" SHEATHING
1500 - FT BM 6" DROP SIDING
2200 - FT BM T+G FLOORING
8 - ROLLS BUILDING PAPER
1 - 3'-0" x 7'-0" x 1¾" DOOR GLAZED 8 LIGHTS WITH FRAME AND HARDWARE
4 - SASH 6 LIGHTS 9" x 12" WITH FRAMES AND HARDWARE
15 - ⅝" x 18" ANCHOR BOLTS
2 - 20" DIAMETER GALV VENTILATORS
6 - 12" x 18" FLOOR VENTS + HARDWARE
3 - 10" x 18" " " " "
3 - ¼" x 1¼" x 12" STRAPS
CAPACITY APPROX 1000 BUSHELS
COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
MISSISSIPPI STATE COLLEGE AND U. S. D. A COOPERATING
SWEET POTATO HOUSE
DRAWN BY EXT AGR'L ENG BLUE PRINT DEPT

FIGURE 5—CONSTRUCTION OF SWEETPOTATO CURING-STORAGE HOUSE

Sweetpotato houses may be constructed in various sizes to suit the need, ranging from 100 bushels to 20,000 or more bushels. The house outlined above is 1000 bushel capacity, and is similar in construction to those larger and smaller. Houses of log construction may also be used, and are satisfactory when properly built. Blue prints and specifications may be had from Extension Service, Agricultural Engineering Department, State College, Miss.

Fertilizer For Sweetpotatoes In Hill Sections of Mississippi

"Growing Sweetpotatoes in the Yazoo-Mississippi Delta" was written particularly in answer to problems confronted by farmers of the Yazoo-Mississippi Delta.

It contains, nevertheless, much valuable data of statewide application; and on account of the importance of sweetpotatoes on farms throughout Mississippi and the large number of inquiries received by the Experiment Station for information on growing sweetpotatoes, it was thought advisable to make it available for general distribution.

In only one respect is an important phase of the bulletin not adaptable to conditions throughout Mississippi.

Typical delta soils contain an abundance of phosphorus and potash, and even worn soils of the area need only nitrogen for maximum crop yields.

This is not true in other parts of Mississippi, and outside the delta proper, complete fertilization is required for sweetpotatoes as for cotton.

The Experiment Station's fertilizer recommendation for sweetpotatoes in the hill sections of Mississippi is 500 to 1000 pounds of 4-8-4 or 6-8-4 or 6-8-8 fertilizer per acre, the variation being due to variation in fertilizer requirements of the different soils.

At the Holly Springs Branch Station, the application of 400 pounds of 4-8-4 gave a three-year average (1934, 1935, 1936) yield of 260 bushels of sweetpotatoes per acre; 400 pounds 4-8-8 gave 263 bushels. In 1937, at the same Station, 1000 pounds of 4-8-4 gave an average of 350 bushels per acre, average of two tests; 1000 pounds 4-8-8 gave 376 bushels.

In the Laurel sweetpotato starch producing area, 40 tests of fertilizing the Triumph variety conducted on the three leading soil types for four years, resulted in average yields per acre as follows:

800 lbs.	2-8-4	300 bushels
800 lbs.	4-8-4	306 bushels
800 lbs.	6-8-4	318 bushels
800 lbs.	8-8-4	332 bushels

Fertility of soil greatly influenced crop response to fertilizers in the Laurel tests. Soils naturally fertile, or made fertile by turning under winter legumes, responded most economically to the low nitrogen application. Soils less fertile at the time fertilizers were applied responded best to the higher percentages of nitrogen.—Editor.

Bulletin No. 328 May, 1939

Fall
versus
Spring Calving

BY RAY H. MEANS
Associate in Animal Husbandry

Mississippi Agricultural Experiment Station
CLARENCE DORMAN, Acting Director
State College, Mississippi

Summary and Conclusions

Increasing interest in beef production in Mississippi and the growing tendency to market slaughter animals as calves occasioned this study by the Animal Husbandry Department of the Mississippi Experiment Station over a period of three years to determine the possibility of increasing profits by the production of fall-born calves.

Use was made of the Experiment Station beef herd and pastures, and detailed observations were made with 119 calves, 62 of which were spring born and 57 fall born, extending from the breeding of the dams through the feeding and slaughter of the calves.

The study revealed certain advantages to be derived from the production of spring-born calves; these being:

(1) A greater per cent calf crop; the difference was about 19%.

(2) Slightly less feed required per calf from birth to end of finishing period.

(3) Slightly less age from birth to the end of the finishing period; the difference was 42 days.

(4) Less trouble occurred from screw worm infestation.

The study similarly revealed certain advantages to be derived from fall-born calves; these being:

(1) A shorter finishing period; the difference was approximately 30 days.

(2) Higher price for good and choice cattle during the marketing period for finished fall-born calves. The difference was approximately $6.00 per head.

(3) A price advantage when marketed as feeders at weaning time.

(4) Dams of fall-born calves weaned in August provided a suckling period two months longer and were in better condition for wintering than dams of spring-born calves weaned in December.

Other observations made in this study show that the number of cows per bull can be materially increased by the practice of breeding some of the cows to calve in the spring and others to calve in the fall. This practice would increase by 100% the number of chances for conception and would enable the reduction in number of bulls by approximately one-half or the breeding of approximately twice as many cows without increasing the number of bulls.

From these results it is evident that consideration should be given to the production of fall-born as well as spring-born calves.

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Fall versus Spring Calving

BY RAY H. MEANS
Associate in Animal Husbandry

An increasing public preference in recent years for smaller cuts of beef has caused feeders to produce relatively fewer heavy cattle and to turn their attention to cattle of lighter weights. This gradual shift has caused certain modifications to be made in the beef industry which have affected the business all the way down the line from the retailer of meats to the producer. The producer is perhaps affected most of all, because different problems are involved in producing choice beef with calves and two-year-old steers. The marketing of calves means a quicker turnover of money for the grower and allows him to carry more cows over a period of time.

Beef cattle will continue to be produced in Mississippi and the income from their sale will constitute one of the major items of Mississppi farms. It is very likely also that in the face of the facts above a large per cent of the cattle that are marketed will be sold as calves, either as veals or weanlings or as baby beeves. As a result of the Agricultural Adjustment Act, more grain is produced on Mississippi farms, and, as never before, there is a seasonable surplus of corn and oats on a great many farms of the state which no doubt will eventually be sold through calves or older cattle.

In the beginning of the beef cattle industry in this country, calves that were destined to survive were born at the season of the year when environment conditions were most favorable to the young. This season was during the spring, after the cold winters had passed and when native food was most abundant. In more recent years, however, farming systems have changed and the old practice of allowing cattle to "root hog or die" during the winter period is fast becoming history. With our present methods of livestock farming, it is a rare occasion that we find a cattle owner who has not made the necessary provision for the maintenance of his herd during the no-grass season. In a number of cases, winter feeds for the cow herd are given first consideration at the beginning of the cropping season.

In spite of the improved conditions under which beef cattle are raised, approximately 50% of all beef calves in the United States, according to Snapp[1], are born during the three months, March April, and May, while the remaining 50% are born throughout the other nine months, with a fairly even distribution except for a slight increase in September and October. As a result of this practice of breeding cows to calve in the spring, a large per cent of the feeder calves and of finishing baby beeves are placed on the market within a relatively short interval of time. This practice tends to depreciate beef cattle values. If the numbers were distributed more uniformly throughout the year, producers would receive a larger return for their product. It is known also that heavier calves will make better feeders or will finish with a shorter feeding period than is possible with March, April, and May calves put on feed the first fall.

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*The author is indebted to Dr. E. W. Sheets, Chief in Animal Husbandry, for his helpful suggestions and criticism; to Professor Henry H. Leveck, who at the beginning of this study, was Acting Head of the Mississippi Experiment Station Animal Husbandry Department, for his assistance in planning and getting the project started; to Mr. Duff Maxwell, Livestock Superintendent, for his assistance in collecting the data; and to Dr. Victor R. Berliner, Associate Professor of Animal Husbandry, for his suggestions in the preparation of this report.

[1] Snapp, Roscoe R., Beef Cattle Production, 1930, p. 117.

Plan of Experiment: Three-Year Study Made With Experiment Station Beef Herd

Because of the importance of the problem of the season of birth of beef calves, this study was undertaken at the Mississippi Experiment Station in 1933. Detailed observations were made with 119 calves, 62 of which were spring-born and 57 fall-born. Steers and heifers were used in both lots. In the fall lot, 34 heifers and 23 steers were used. In the spring group, 31 heifers and 31 steers were used. On account of a lack of numbers to select from in the fall group, it was impossible to get an equal number from each sex.

In this study, an attempt was made to obtain data on the following phases of this problem:

1. Breeding efficiency of cows and bulls at different seasons of the year.
2. Significance of birth weights of beef calves.
3. Performance of calves born at different seasons of the year. Included in this phase was rate of gain and feed required to produce 100 pounds of beef.

This study was made with the beef herd on the Mississippi Experiment Station farm. A period of three years was required in order to get the necessary data and to eliminate as far as possible any annual variations in season and other conditions. The cows used were mature, high grade, and of good beef type. About half of them were Hereford and one-half were Angus breeding. Purebred Hereford and Angus bulls were used and in each case the bull was mature and in good thrifty condition. In each group of calves were Herefords, Angus, and crossbreds. Both heifers and steers were used in each lot.

Since the cow herd, prior to this experiment, had calved normally in the spring, some loss of time was experienced in breeding for the first crop of fall calves. The plan was to use 21 calves in the fall lot and the same number in the spring lot. For various reasons, it was not possible to finish this number in all lots. The breeding dates were December 15 to March 15 for fall calves, and May 15 to August 15 for spring calves. Allowing 283 days for period of gestation, the cows in the two lots should normally have started calving during the latter part of September and the latter part of February.

The dams of the fall calves were maintained on pasture only during the grazing season and during part of the wintering period on stalk fields and supplemental grazing crops. The rest of the winter they were fed roughage in the form of sorghum silage and Johnson grass hay and 2 pounds cottonseed meal daily. The dams of the spring calves likewise were maintained on pasture only during the grazing season and since they were dry during the winter they were maintained on sorghum silage, Johnson grass hay, and 1 pound cottonseed meal per head per day.

Both lots of calves were creep fed corn and cottonseed meal free choice on pasture. The fall-born calves were creep fed 1½ pounds grain per head per day, composed of 8 parts corn and 1 part cottonseed meal, while they were in dry lot with their dams. The first lot of fall calves reached the desired finished weight by the end of the grazing season. It was necessary to finish some of the calves in the 1935 and 1936 fall groups in dry lot, and all calves in the spring group received dry lot feeding after grazing season and before they reached the desired finished weight. The average slaughter weight for all calves in both groups was approximately 700 pounds.

Improved pastures were available and used with the cows and calves in this experiment from March 20 to December 15. While on pasture, the source of water supply was ponds or pools and, during the dry lot or wintering periods, deep well water was supplied in concrete tanks. Salt in the compressed or brick form was used. No other minerals were fed. Considering the difference in season, the calves and dams in the two lots were handled as nearly alike as was practicable for comparable results.

Review of Literature

The study of beef calves born at different seasons of the year has been made only in a brief way. No published data are available pertaining to this particular study.

Snapp[2] points out six advantages of spring-born calves and eight advantages of fall-born calves. Severson[3] states that fall calves are cheaper than spring calves both for breeding and feeding. Ward and Jerdan[4] found that calves too young to wean and fatten for market in the fall can be made to pay a nice profit by letting them nurse the cows during the winter, feeding them grain on grass the following summer and selling them in the fall.

In regard to other classes of livestock, Arnold and Becker[5] conclude that there is no significant difference in annual milk yield of Jersey cows calving at different seasons of the year. Ferrin and McCarty[6] found that there is no significant difference in rate of gain and feed required to produce 100 pounds gain of fall-farrowed and spring-farrowed pigs.

Birth weights and performance records are not available for calves born at different seasons of the year, but Poljakov and Polpanskii found that the birth weights of spring-born male and female calves out of milking Shorthorn cows was 33 kg. and 30 kg., respectively. White[8] reports that the average birth weight of 116 crossbred Holstein and Angus calves was 91 pounds for males and 85 pounds for females. Severson[9] gives the birth weight of Angus spring-born calves as 71.6 pounds. Other investigators have found that the rate of gain of pigs during the suckling and finishing periods was influenced by birth weights. Smith[10] brings out this fact in a table which includes the birth weights of 1429 pigs. He states that the average birth weight of pigs is approximately 2½ pounds. Pigs weighing 1 to 1½ pounds make .38 and 1.18 pounds daily gain for suckling and finishing periods, respectively, while pigs weighing from 2½ to 2¾ pounds make .52 and 1.32 pounds daily gain for the two periods.

The rate of gain of the spring calves used in this study was in line with that obtained by other investigators. Bray[11] secured an average daily gain for a four-year period of 1.93 pounds when spring calves were creep fed on pasture. Trowbridge and Moffit[12], using the same ration with steer calves that was fed in this experiment, obtained 2.13 pounds daily gain to weaning time. The writer [13] found that creep-fed steer and heifer calves made the following daily gains: 1931—1.9 and 1.8; 1932—2.1 and 1.9, respectively. Morrison [14] gives results of 14 tests of creep feeding calves with an average daily gain of 1.79 pounds.

The breeding efficiency of some classes of farm animals, both males and females, is apparently influenced by weather conditions and plane of nutrition. McKenzie and Berliner[16] state that among other things the abnormal sperm increased during the summer with some rams and returned to normal level during the fall months. These authors found that the reproductive organs of bulls functioned in a similar way. Furthermore, it was found that overfeeding can disturb the normal spermatogenic activity in some males, while proper feeding can increase this function and inadequate care and undernutrition can impair sperm production.

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[2] Snapp, Beef Cattle Production, p. 118.

[3] Severson, B. O., American Society of Animal Production, Fenn. Agri. Exp. Sta., Nov. 1920, p. 14.

[4] Ward, W. F., and Jerdan, S. S., Bul. 631, Calf Feeding in Alabama and Mississippi, U. S. Dept. of Agri., p. 53, 1918.

[5] Arnold, P. T. D., and Becker, R. B., Journal Dairy Science, Fla. Agri. Exp. Sta., vol. XVIII, pp. 621-628.

[6] Ferrin, E. F., and McCarty, M. A., American Society of Animal Production, Univ. of Minn., 1923.

[7] Poljakov, I. A., and Polpanskii, A. P., Animal Breeding Abstracts, June, 1935, p. 141.

[8] White, W. T., Journal Dairy Science, 1934, Alaska Exp. Sta., Kokiak, vol. XVII, pp. 709-716.

[9] Severson, American Society of Animal Production, Fenn. Agri. Exp. Sta., Dec. 1915.

[10] Smith, William W., Pork Production, 1937, p. 113.

[11] Bray, Chas. I., American Society of Animal Production, La. Agri. Exp. Sta., 1934, p. 96.

[12] Trowbridge, E. A., and Moffit, H. C., Research Bul. 285, Mo. Exp. Sta., 1930, p. 51.

[13] Unpublished Data, Miss. Exp. Sta., 1931 and 1932.

[14] Morrison, F. B., Feeds and Feeding, 20th Edition, p. 706.

Rice[17] gives the normal breeding season for cattle as any time during the year, while horses, sheep, and swine have a restricted season. Shepherds have long been aware that flushing—getting ewes in a rising condition—results in a larger lamb crop than with ewes not flushed. Horlacher[18] refers to work done along this line by the United States Department of Agriculture which shows that ewes that are flushed produce a larger number of twins and that they all breed more nearly at the same time. This results in a lamb crop of much more uniformity in age and size.

Range cattlement have found when cattle are maintained on a good plane of nutrition a larger annual calf crop is possible than with cattle that are kept on a low plane of nutrition. Green[19] points out that native range cows handled under range conditions produced a calf crop every two years, or a 50% calf crop, while cows on improved carpet grass and lespededa pasture, otherwise handled in a similar way, were in proper physical condition to calve annually.

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[15] McKenzie, Fred F. and Berlinger, V. R., Reproductive Capacity of Rams, Bul. 265, Mo. Exp. Sta., 1937.

[16] McKenzie and Berliner, Unpublished Data, Mo. Exp. Sta., 1935.

[17] Rice, Victor Arthur, Breeding and Improvement of Farm Animals, 1st Edition, p. 87.

[18] Horlacher, Levi Jackson, Sheep Production, 1st Edition, 1927.

Breeding Efficiency of Cows and Bulls at Different Seasons of The Year

Although beef cows do not inherit a tendency for seasonal breeding and the reproductive organs of bulls apparently function better in cool than hot weather, it was found in these experiments that the per cent calf crop is lower when beef cows are winter-bred than when summer-bred. For each lot of fall calves, 30 cows were bred. Twenty-two calves were born in the fall of 1934, 19 in the fall of 1935, and 18 in the fall of 1936. Thus the per cent calf crop from beef cows when winter-bred averaged about 66%, while similar cows bred to similar bulls in summer will normally produce on the average 85% calf crop. The average weight of the cows that produced fall calves was 1079 pounds on December 6 and 994 pounds on March 22. This represented a decrease in weight of 85 pounds during the wintering period. Dry cows wintered in this manner will gain on the average about 50 pounds. This loss in weight, along with the effects from a lack of necessary minerals and vitamins during the no-grass period, are suggested causes for difference in calf-crop percentage from cows bred during the winter and during summer. It is apparent that this phase of the study should be further investigated for conclusive results.

Throughout the experiment, such of the cows as were bred for fall calves and failed to conceive were re-bred in the succeeding period and most of them produced spring calves.

Significance of Birth Weights of Beef Calves: Fall-Born vs. Spring-Born

The birth weights of beef calves was also given special consideration, since the calf that makes the most rapid gains usually produces the most economical beef. The weight was recorded on each calf the day it was born. Figure 1 shows the weights of three calves selected from the 1934 fall lot. It will be noted that two of these calves were born November 2 and the other born on November 4. One calf weighed 90 pounds, one 55 pounds, and the third 70 pounds, the last of which is near the average of the lot. The 90-pound calf weighed 740 pounds on October 18, the 70-pound calf 685 pounds, and the 55-pound calf 600 pounds on the same date. The daily gains from birth to October 18, 350 days, were 2.1 pounds for the 90-pound calf, 1.95 for the 70-pound calf, and 1.7 pounds for the 55-pound calf. Since these calves were fed as a group, the individual feed consumption per unit of gain could not be ascertained. It is recognized that hereditary and environmental influences can and do play an important part with beef calves before birth and during the suckling and finishing period. The illustration above, however, is representative of the results obtained in these experiments.

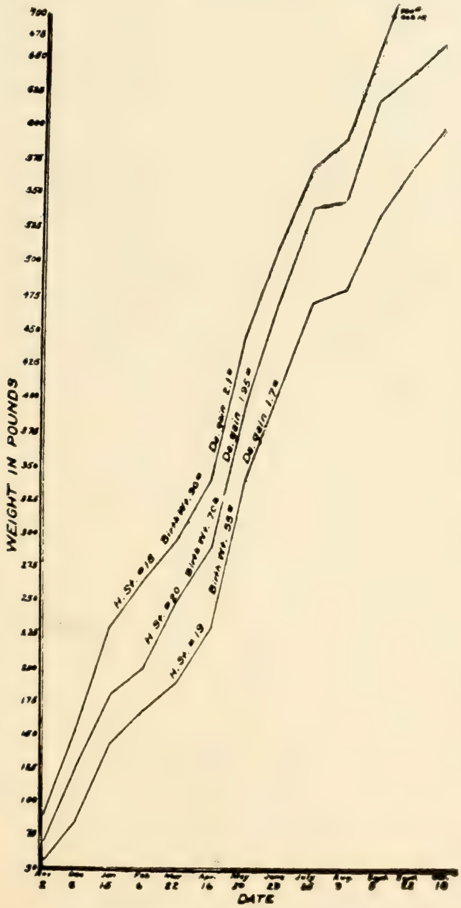


FIG. 1—INDIVIDUAL BIRTH WEIGHT, BIRTH DATE, DAILY GAIN, AND FINAL WEIGHT OF 3 CALVES FROM THE 1934 FALL LOT

It was found in these experiments that, on the average, male calves are heavier at birth than females. The average birth weight of 55 male calves was 69.9 pounds, while that of 64 female calves was 67.5 pounds. There was a difference of 2.4 pounds in favor of male calves. The average birth weight of 34 fall-born heifers was 68.8 pounds and 30 spring-born heifers was 66.1 pounds. The average birth weight of 23 fall-born males was 72.2 pounds and 32 spring-born males 68.2 pounds. There was a difference of 2.8 pounds in favor of fall-born calves. The average birth weight of 57 fall-born males and females was 70 pounds. The average birth weight of 62 spring-born males and females was 67.2 pounds.

The average birth date of the fall-born calves was about October 28, ranging from September 29 to January 9, while that of the spring-born calves was about March 22, ranging from February 1 to May 12.

Performance of Calves Born at Different Seasons of The Year

Tables 1, 2, 3, and 4 and figures 2, 3, and 4 show a summary of the results obtained with each lot of calves by years and an average of the three years. There are some slight yearly variations, but, as a whole, the results are consistent. It is noted that the calves in both lots reached the desired slaughter weight in about 12 months. On the average, the spring-born calves finished at a 42-day younger age than the fall-born calves. The rate of gain during the grain feeding period was slightly in favor of the fall-born calves.

The total grain required per calf, including the grain fed to the fall calves during the wintering period, was 1846 pounds for the fall-born calves and 1848.5 pounds for the spring-born calves. The fall calves consumed 1591 pounds of corn and 255 pounds of cottonseed meal. The spring calves consumed 1567.9 pounds of corn and 280.6 pounds of cottonseed meal. The fall calves should be charged with 95 pounds of cottonseed meal and about one-fourth of a ton of sorghum silage, which is the feed that the fall cows consumed in addition to that consumed by dry cows during the wintering period. If the small amount of roughage used and the maintenance of the dam is not taken into consideration, each calf in the fall group represents a total grain consumption of 1941 pounds and each spring calf 1848.5 pounds from birth to the end of the finishing period.

The calves in both lots had free access to corn and cottonseed meal, both of which were available in creeps while the calves were on pasture.

TABLE 1—COMPARISON OF 1934 FALL-BORN AND 1935 SPRING-BORN CALVES

	Lot 1 1934 Fall Calves	Lot 2 1935 Spring Calves
Number of calves	20	21
Average birth wts. (lbs.):		
Males	70.8	70.2
Females	65.3	65.3
All calves	68.3	67.6
Average initial wt., experimental feeding period (lbs.)	315.1	252.3
Average final wt. (lbs.)	700.0	700.7
Average total gain (lbs.)	384.9	448.4
Average daily gain (lbs.)	1.94	1.7
Average age of feeder (days)	173.0	94.0
Length of feeding period (days)	198	264
Average age at end of finishing period (days)	371	358
Average dressing per cent	61.4	62.0
Average chilling per cent	1.9	1.9
Feed consumed per calf per day (lbs.):		
Corn	7.25	7.38
Cottonseed meal	.86	1.1
Sorghum silage	----	5.6*
Johnson grass hay	----	1.9*
Feed consumed per 100 lbs. gain (lbs.):		
Corn	373.7	434
Cottonseed meal	44.3	64.7
Sorghum silage	----	125.5*
Johnson grass hay	----	44.0*

*Calculated on number of days calves were fed in the barn.

TABLE 2—COMPARISON OF 1935 FALL-BORN AND 1936 SPRING-BORN CALVES

	Lot 1 1935 Fall Calves	Lot 2 1936 Spring Calves
Number of calves	19	20
Average birth wts. (lbs.):		
Males	76.0	62
Females	73.3	64
All calves	83.2	62.8
Average initial wt., experimental feeding period (lbs.)	316.3	269.1
Average final wt. (lbs.)	705.8	695.2
Average total gain (lbs.)	389.5	430.1
Average daily gain (lbs.)	2.02	1.93
Average age of feeder (days)	163	104
Length of feeding period (days)	192	222
Average age at end of finishing period (days)	355	326
Average dressing per cent	62.0	61.9
Average chilling per cent	1.5	1.4
Feed consumed per calf per day (lbs.):		
Corn	7.88	7.00
Cottonseed meal	.67	.86
Sorghum silage	....	2.83*
Johnson grass hay		1.45*
Feed consumed per 100 lbs. gain (lbs.):		
Corn	390.0	364.58
Cottonseed meal	33.16	44.78
Sorghum silage	....	52.76*
Johnson grass hay	....	26.72*

*Calculated on number of days calves were fed in the barn.

TABLE 3—COMPARISON OF 1936 FALL-BORN AND 1937 SPRING-BORN CALVES

	Lot 1 1936 Fall Calves	Lot 2 1937 Spring Calves
Number of calves	18	21
Average birth wts. (lbs.):		
Males	70.2	72.7
Females	68.5	69.0
All calves	69.0	70.9
Average initial wt., experimental feeding period (lbs.)	299.0	276.2
Average final wt. (lbs.)	695.1	687.1
Average total gain (lbs.)	396.1	410.9
Average daily gain (lbs.)	1.72	1.96
Average age of feeder (days)	165.0	99.0
Length of feeding period (days)	230	209
Average age at end of finishing period (days)	395	308
Average dressing per cent	61.4	62.5
Average chilling per cent	1.9	1.9
Feed consumed per calf per day (lbs.):		
Corn	6.32	5.81
Cottonseed meal	1.93	1.64
Johnson grass hay	.65*	3.58
Feed consumed per 100 lbs. gain (lbs.):		
Corn	367.4	296.4
Cottonseed meal	112.2	83.67
Johnson grass hay	35.0*	49.11

*Hay consumed by 7 calves while in barn.

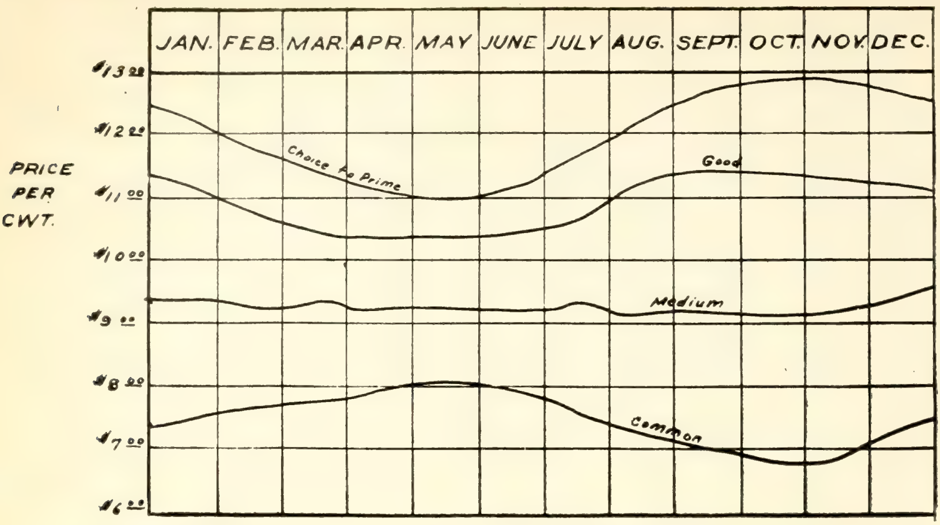


FIG. 5—AVERAGE MONTHLY PRICE OF STEERS OF THE VARIOUS GRADES AT THE CHICAGO MARKET FROM 1922 TO 1928.

TABLE 4—COMPARISON OF FALL-BORN AND SPRING-BORN CALVES—THREE-YEAR AVERAGE

	Lot 1 **Fall Calves**	Lot 2 Spring Calves
Number of calves (total)	57	62
Average birth wt. (lbs.):		
All calves	70.0	67.2
Average initial wt. (lbs.)	310.1	265.9
Average final wt. (lbs.)	700.3	694.3
Average total gain (lbs.)	390.2	428.4
Average daily gain (lbs.)	1.88	1.83
Average age of feeder (days)	167	99
Length of feeding period (days)	207	233
Average age at end of finishing period (days)	374	332
Average dressing per cent	61.6	62.1
Average chilling per cent	1.8	1.7
Slaughter grade:		
Number choice calves	27	29.
Number good calves	30	32
Number medium calves		1
Feed consumed per calf per day (lbs.):		
Corn	7.15	6.73
Cottonseed meal	1.15	1.20
Sorghum silage	......	*4.22
Johnson grass hay	.65	2.31
Feed consumed per 100 lbs. gain (lbs.):		
Corn	379.3	366.0
Cottonseed meal	61.0	65.5
Sorghum silage	......	39.1
Johnson grass hay	35.0	39.9

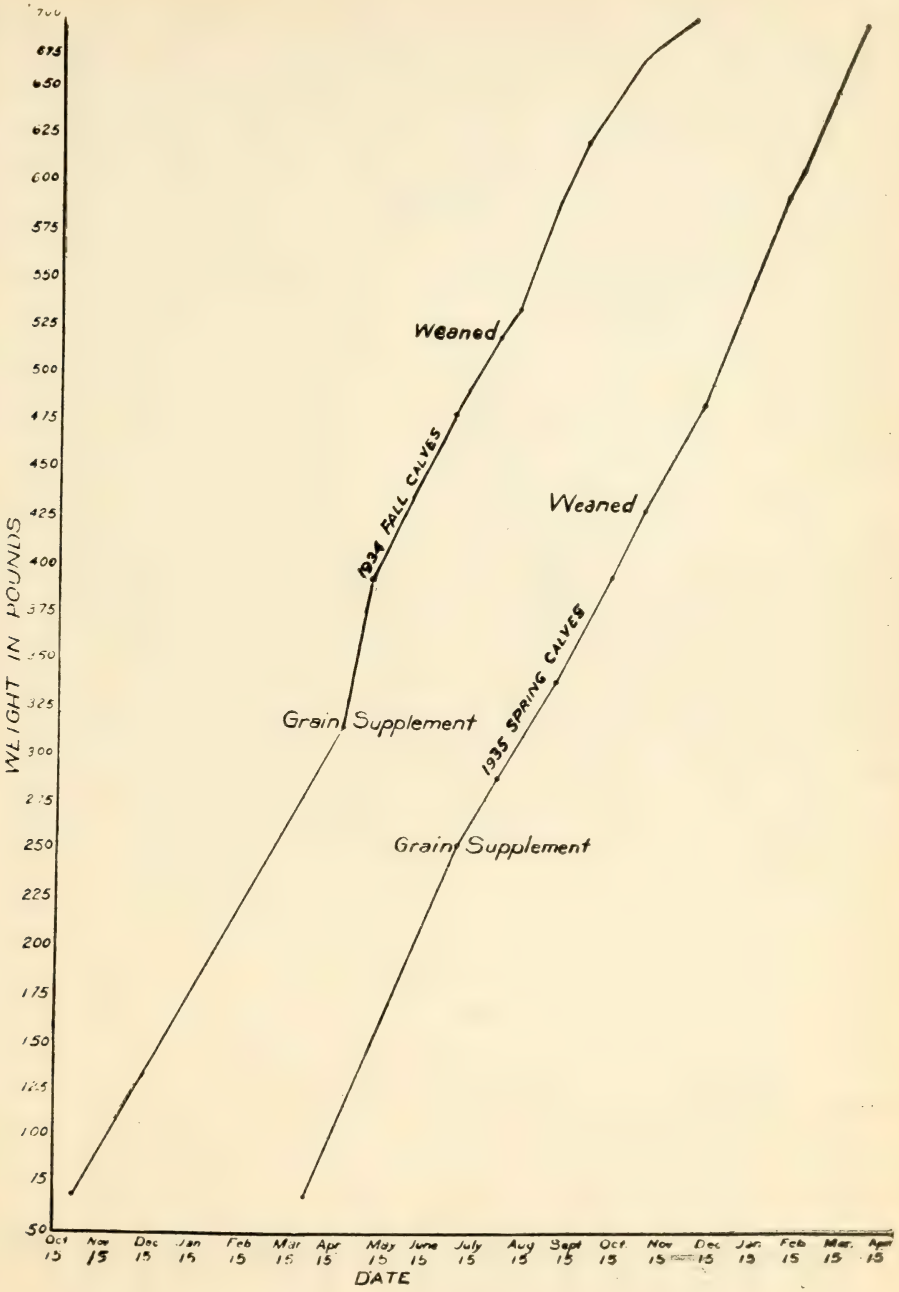


FIGURE 2—COMPARISON OF 1934 FALL-BORN AND 1935 SPRING-BORN CALVES

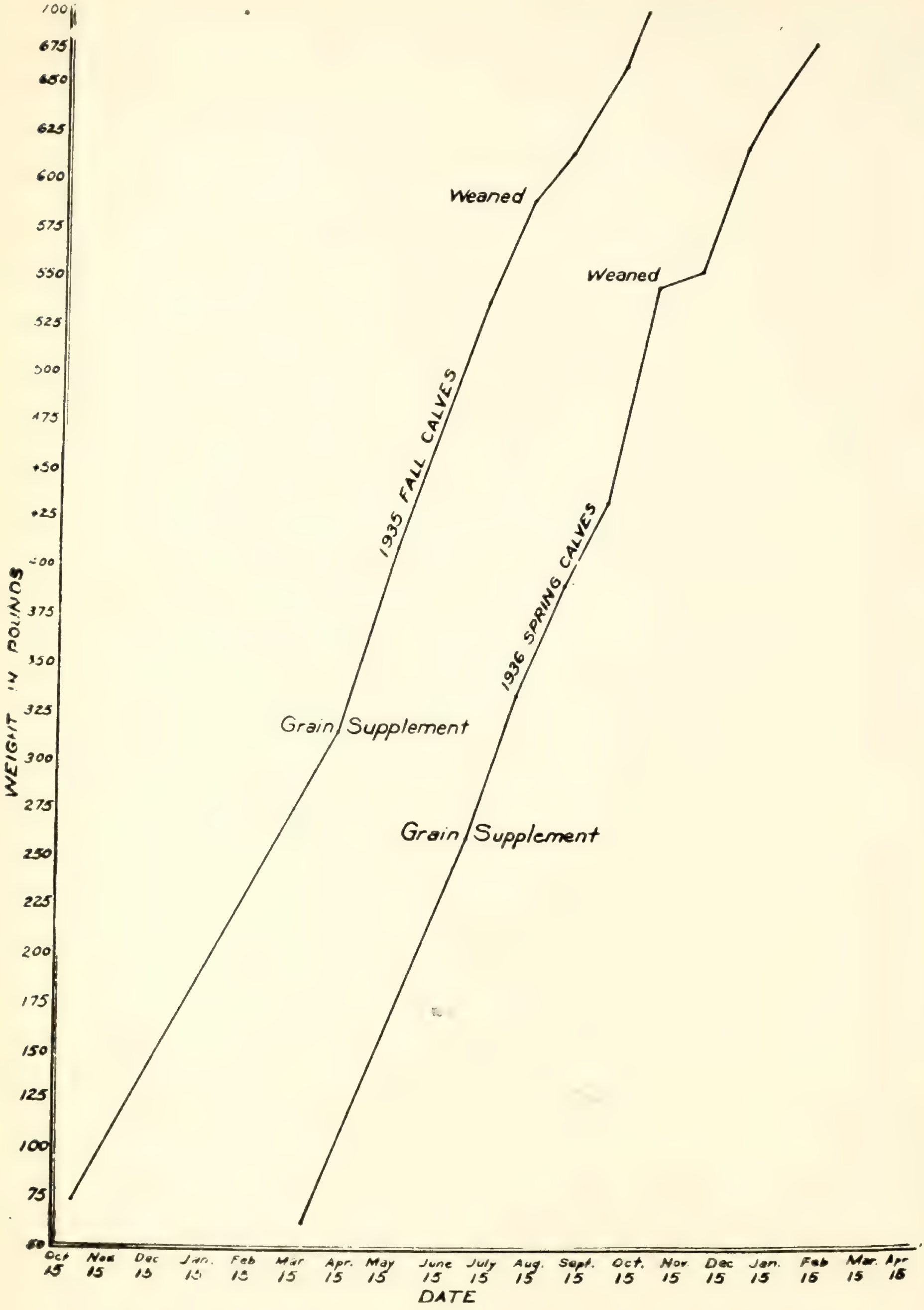


FIGURE 3—COMPARISON OF 1935 FALL-BORN AND 1936 SPRING-BORN CALVES

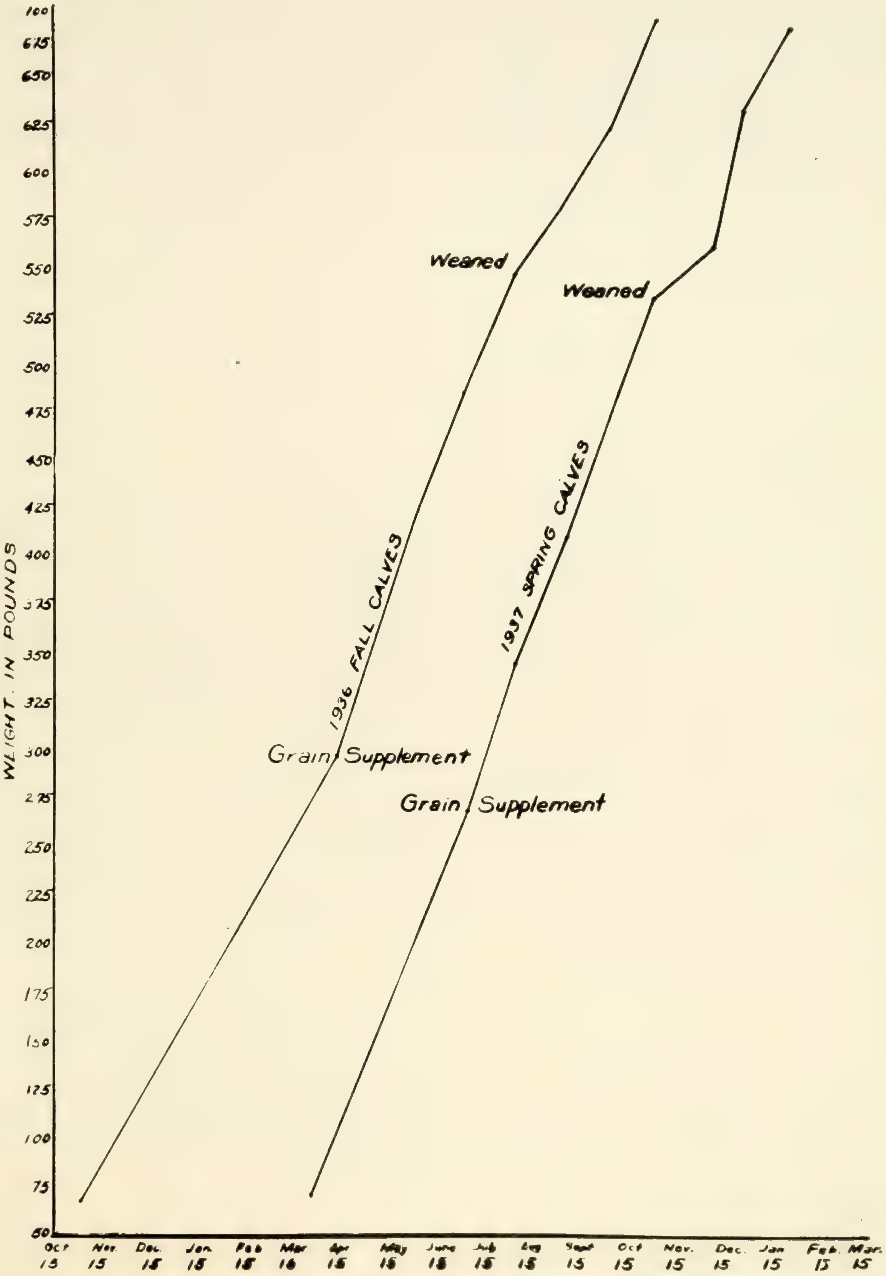


FIGURE 4—COMPARISON OF 1936 FALL-BORN AND 1937 SPRING-BORN CALVES

On account of the seasonal variation in market price of cattle of these grades, the fall-born calves could be sold at a better price per pound than spring-born calves. It is noted (fig. 5) that good and choice cattle sell at a higher price per hundred pounds in October and November than in February and March. The price of feeder cattle and butcher cattle of the lower grades is usually less at this season due to the heavy run of grass cattle and the cull dairy cows on all central markets.

Since all calves used in this study were slaughtered locally and the carcasses disposed of locally, it was not possible to obtain a comparative selling price for the two lots. Detailed carcass studies were made of each animal and a rib cut from each carcass was shipped to Washington, D. C., where detailed cooking and palatability studies were made of the meat. Differences between carcasses of fall-born and spring-born calves were not significant.

Observations pertaining to the health of the animals used in this study should be given some consideration. None of the spring-born calves that were used in the test became ill or were infested with parasites, while the navels of some of the fall-born calves each year became infested with Calliphorine myiasis, commonly known as screw-worms. This trouble usually occurred with the first calves born or those that were born before frost. The fall-born calves were probably not disturbed as much by flies and mosquitoes as the spring-born calves. The male calves in each lot were castrated at about two months of age. This operation apparently did not affect their health or rate of gain.

The cows that produced fall calves, having been dry since August, were carrying more flesh at calving time than the cows that produced spring calves. It was found to be advisable to keep the fall calves with their dams approximately two months longer than was the practice with spring calves because of the abundance of forage during the summer.

Bibliography

A. Books.

Horlacher, Levi Jackson, **Sheep Production**, 1st edition, 1927.

Morrison, F. B., **Feeds and Feeding**, 20th edition, p. 706.

Rice, Victor Arthur, **Breeding and Improvement of Farm Animals**, 1st edition, p. 87.

Smith, William W., **Pork Production**, 1937, p. 113.

Snapp, Roscoe R., **Beef Cattle Production**, 1930, p. 117.

B. Bulletins.

McKenzie, Fred F., and Berliner, V. R., **Reproductive Capacity of Rams**, Bul. 265, Mo. Exp. Sta., 1937.

Trowbridge, E. A., and Moffitt, H. C., Research Bul. 285, Mo. Exp. Sta. 1930, p. 51.

Ward, W. F., and Jordan, S. S., Bul. 631, **Calf Feeding in Alabama and Mississippi**, U. S. Dept. of Agri., p. 53, 1918.

C. Articles.

Arnold, P. T. D., and Becker, R. B., **Journal Dairy Science**, Fyr. Agri. Exp. Sta., vol. XVIII, pp. 621-628.

Bray, Chas. I., **American Society of Animal Production**, La. Agri. Exp. Sta., 1934, p. 96.

Ferrin, H. F., and McCarty, M. A., **American Society of Animal Production**, Univ. of Minn., 1923.

Greene, S. W., in charge, Coastal Plain Exp. Sta., McNeill, Miss., **Proc. Southern Agri. Workers Asso.**, 1927.

Poljakov, I. A., and Poljanskii, A. P., **Animal Breeding Abstracts**, June, 1935, p. 141.

Severson, B. C., **American Society of Animal Production**, Penn. Agri. Exp. Sta., Dec. 1915.

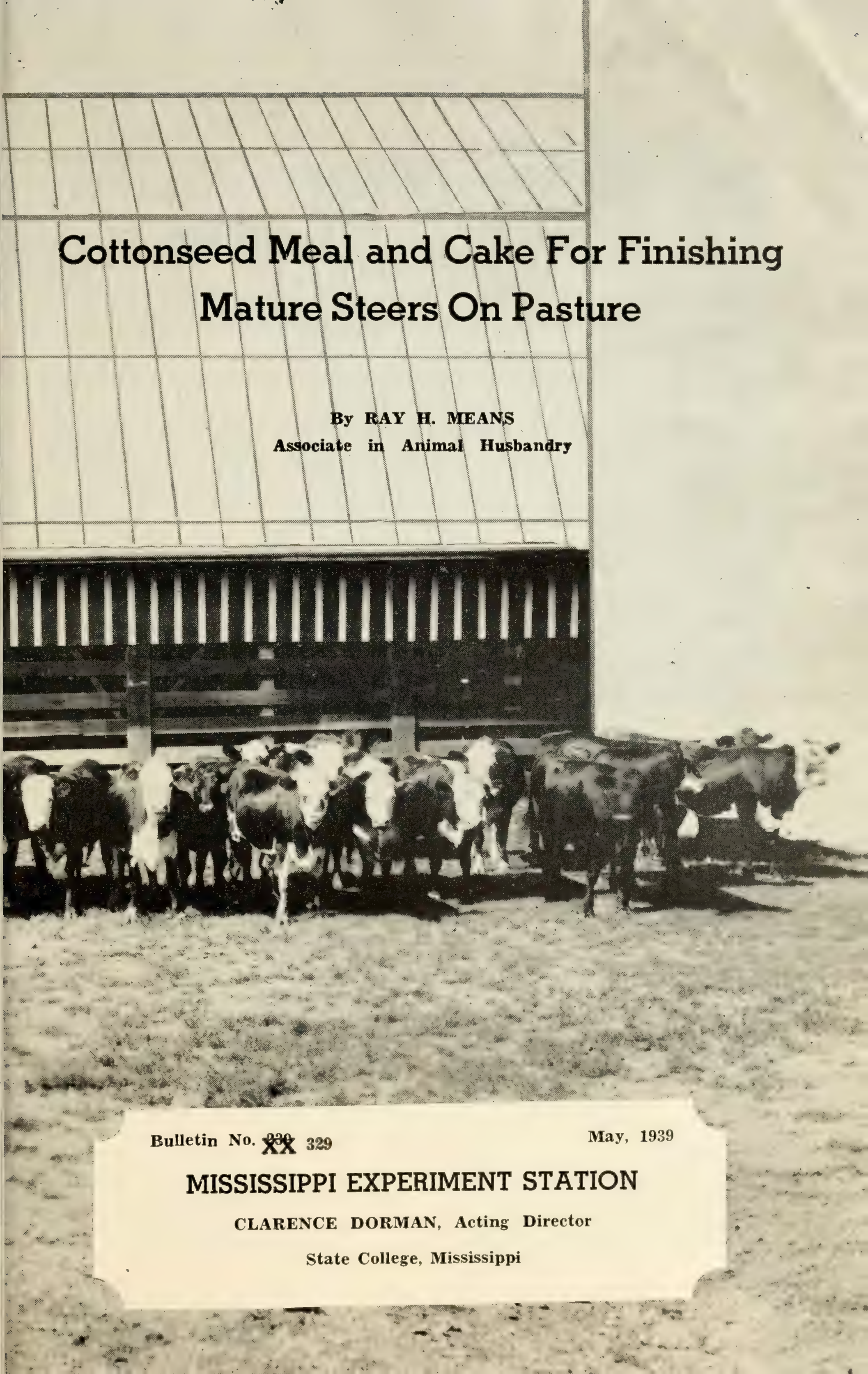
Severson, B. C., **American Society of Animal Production**, Penn. Agri. Exp. Sta., Nov. 1920, p. 14.

White, W. T., **Journal Dairy Science**, 1934, Alaska Exp Sta., Kodiak, vol. XVII, pp. 709-716.

D. Manuscripts.

McKenzie, Fred F., and Berliner, V. R., Unpublished Data, Mo. Exp. Sta., 1935.

Means, R. H., Unpublished Data, Miss. Exp. Sta., 1931 and 1932.



Cottonseed Meal and Cake For Finishing Mature Steers On Pasture

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MISSISSIPPI EXPERIMENT STATION

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Summary and Conclusions

The feeding of a supplementary ration of cottonseed meal or cake to steers grazing on good pasture was the subject of three years of investigations by the Animal Husbandry Department of the Mississippi Agricultural Experiment Station. During the course of these investigations it was sought to determine whether such supplementary feeding might be practical and profitable, the level at which cottonseed meal or cake might most economically be fed, and the most profitable length of grazing and feeding period.

In order that the data might be widely applicable throughout Mississippi, steers used in the tests were of three predominating classifications such as are generally found throughout the state. These were: (1) Grade Jersey or "Yellow Hammer" steers; (2) First cross steers from native or Jersey cows, sired by a beef type bull; and (3) Good grade beef type steers.

The experiment was conducted on the pastures of the Experiment Station at State College, Mississippi. These pastures are typical of the better pastures in the northeast prairie section and are of such quality that steers not given the supplementary feed gained an average of more than 200 pounds during the tested grazing periods of approximately 4 months.

On the basis of these experiments, three definite conclusions seem warranted. They are:

1. The feeding of cottonseed meal or cake to mature steers whether of common, or medium or good breeding, on good pasture proved to be unprofitable.
2. It was more profitable to market such steers in August than nearer the end of the grazing season.
3. In only one year out of the three did the feeding of 5 pounds of cottonseed meal show an advantage over the feeding of 2½ pounds of cottonseed meal per steer per day.

The 1933 experiment conducted with Jersey or "Yellow Hammer" steers reflected little difference in total and daily gains, or in grade or in selling price per 100 pounds, whether the pasturage was supplemented with 5 pounds cottonseed cake per day or 2½ pounds cottonseed cake per day or whether pasture alone was used. Steers marketed August 11 proved more profitable than steers marketed October 3.

In the 1934 experiment, 30 Angus-Jersey steers showed little difference in daily gain or in total gain per steer, or in market grade, whether fed cottonseed meal in addition to pasture or whether on pasture only.

In the 1935 experiment, using 30 grade Hereford steers, those fed 5 pounds of cottonseed meal made .29 pounds more daily gain per steer than those fed the light meal ration and sold for 85c more per 100 pounds. The increase rate in gain, however, was more than offset by the cost of the supplement, and was not justified by sufficiently increased price per 100 pounds live weight Steers fed 2½ pounds cottonseed meal daily made practically the same rate of gain as the steers receiving pasture only and were appraised at 60c less per 100 pounds when marketed.

No account was taken of the fertility value of cottonseed meal fed to steers and returned to the soil in the manure. Such value during the grazing period approximates $2.50 per head for those steers fed 2½ pounds of cottonseed meal daily and $5.00 per head for those fed 5 pounds of cottonseed meal daily.

Cottonseed Meal and Cake For Finishing Mature Steers On Pasture

By RAY H. MEANS
Associate in Animal Husbandry

A large number of steers produced or handled in Mississippi are fattened on grass and sold at the end of the grazing season as grass fat steers. Most of the steers marketed off of grass do not carry the finish desired by packers as is evidenced by the selling price per 100 pounds live weight. To the end that this class of cattle might be handled more advantageously, it was thought advisable to do some experimental work along the lines of supplemental feeding on pasture. Since cottonseed meal is usually the cheapest concentrate produced in the state and is more generally used for feeding cattle than any other concentrate, it was selected as the feed to be used in these experiments. Cottonseed cake has some advantage when feeding is done in the open or under pasture conditions, however, the cake is not as accessible as the meal. This is evidenced by the fact that it was convenient to purchase the cake only one year in the three years that the experiment was conducted.

Results reported up to date on the feeding of cottonseed meal to steers on pasture are not consistent. Grimes, Sowell and Cottier (Circ. 72, Ala. Exp. Sta.) state that it was profitable to feed meal during five of the six years of experiments conducted in the Black Belt of Alabama during the grazing seasons of 1927 through 1932. Two-year-old high grade Hereford steers used in these tests made an average gain for the 6-year period of 205 pounds when pasture was supplemented, and 157 pounds when on pasture only.

Barnett and Goodell state among other things, that cottonseed meal fed to steers on grass did not increase the gains sufficiently to offset the added cost of meal. These experiments were conducted by the Mississippi Experiment Station in 1917, under conditions somewhat similar to those of the work here reported.

Sought in Experiments

The objects of these experiments were (1) to determine the economy of feeding cottonseed meal to steers on pasture; (2) to determine the amounts of cottonseed meal or cake feeding most economical; and (3) to determine the most profitable length of feeding period.

Plan of Work—The plan was to use three lots of steers; Lot 1 to be fed in addition to pasture 5 pounds cottonseed meal or cake per steer per day, Lot 2 in addition to pasture 2½ pounds of cottonseed meal or cake per steer per day, and Lot 3 pasture only. The original plan was to use 24 steers in each lot, and to market one-half of the steers in each lot in August and continue the remainder of the steers on feed and pasture to the end of the grazing season. At the end of the first trial, however, it was decided to limit the number of steers in each lot to ten. This number was handled in each of three lots during the 1934 and 1935 trials. The steers in all lots were to have access to similar conditions with reference to quality and quantity of pasture, water, shade, the only variable being the cottonseed meal or cake fed to Lots 1 and 2.

Three Grades of Steers Used In Successive Years To Evaluate Supplemental Feeding of Cottonseed Meal

As commonly practiced in Mississippi, three general grades of steers are marketed off of grass. These include steers of predominately Jersey breeding, locally known as "Yellow Hammer"; steers representing the first cross between cows predominately Jersey or native and a beef type bull, and steers predominately of the beef type locally known as high grades. In this experiment, use was made in 1933 of 72 Jersey or "Yellow Hammer" steers; in 1934, of 30 two-year old common grade Angus steers, practically all being first crosses from native or Jersey cows sired by an Angus bull; and in 1935 of 30 two-year old good grade Hereford steers including a few good cross breeds.

Feeding and Management

Each spring before the steers were weighed for the experiment they were turned on pasture from 20 to 30 days in order that they would become accustomed to the pasture. It was also desirable to delay the starting of the experiments until the grass and clovers had made a good growth. At the beginning of the experiment the steers were divided into three uniform lots and turned in three pastures and thereafter fed or handled as outlined under "Plan of Work."

The 1933 experiment was divided into two periods, and twenty-four steers were used in each of the three lots. On August 11, each lot was divided into two uniform groups of twelve steers each. One group from each lot was shipped to market and sold on August 14, while the remaining groups, referred to as Lots 1A, 2A, and 3A, were continued on the experiment until October 3.

The steers used in the 1933 experiment were not changed from one pasture to the other from the time they were put on the test until they were sold. However, it was thought advisable upon the beginning of the second year's work to change the steers within the three pastures each 21 days; that is, at the end of the first 21-day period put lot 1 into the pasture that had been occupied by lot 2, put lot 2 where lot 3 had been, and put lot 3 where lot 1 had been. This method of changing pastures was carried out with both the 1934 and 1935 cattle in order to eliminate any advantage in quantity or quality of grazing that there might have existed in any of the three pastures.

The meal was fed once daily about 8 o'clock A. M. in open troughs 4 feet wide and of sufficient length to accommodate all cattle. A supply of meal was stored in each pasture in portable houses in order to facilitate feeding. Rock salt was available at all times. No other minerals were used.

Pastures Used in Experiment

The pastures used for these experiments are located at State College, Mississippi, and are representative of the better pasures in the northeastern prairie section. They are of such quality as to furnish abundant grazing for an 800-pound steer per acre, and steers, furnished pasture alone in this test consistently gained more than 200 pounds during grazing seasons which ended about mid-August.

From the beginning of the grazing season to May 15 approximately 90 per cent of the pasturage was yellow hop clover. The remaining 10 per cent consisted of wild barley, cheat, white clover and black medic. From about May 15 through the remainder of the grazing season, Dallis grass furnished about 80 per cent of the grazing. Small amounts of Bermuda grass, crab grass and lespedeza were present. In each pasture there was an abundance of grazing at all times except for a brief dry period from June 25 to July 12, 1933.

Several trees in each pasture afforded all shade that was necessary. Water was supplied by ponds or pools. The pastures were clipped with a mowing machine at least once during each grazing season to keep the grass tender and to destroy weeds, brush and briers. The acreage contained in the three pastures used in 1933 were 33, 33, and 89 acres for Lots 1, 2, and 3, respectively. The pastures used for Lots 1 and 2 in the 1933 trial were used for all three experiments, but at the beginning of the 1934 trial a smaller pasture containing 58 acres was selected and used the last two grazing seasons instead of the 89 acre pasture used in 1933.

Weights Recorded

On account of the distance of the pastures from the scale, the steers in some cases were not weighed on three consecutive days at the beginning and at the end of the experiments. It was thought that more than one or two weights secured after the steers had traveled a mile and one-half in hot weather would not be representative of the true weight. Therefore, the average weights given represent from one to three weights taken at the beginning and end of the trials. During the 1934 and 1935 trials the steers were weighed at the end of each 21-day period or when a change in pasture was made.

All the steers used in the 1933 experiment were shipped to East St. Louis and sold through a commission firm. One-half of each lot was sold on August 14 and the remaining half sold on October 5. The 1934 steers were slaughtered in Starkville and the beef disposed of through the College Cafeteria. The cattle were graded before they were slaughtered on the basis of the U. S. D. A. standard. Dressing percentage was determined on hot weight basis. The 1935 steers were shipped to East St. Louis where individual slaughtering records were secured.

Cottonseed cake of broken slab type was used throughout the 1933 experiment. In the 1934 and 1935 trials cottonseed meal was used because of difficulty in obtaining cake. All the cake and meal fed analyzed at least 41 per cent protein. Costs were as follows: 1933 cottonseed cake, $18.00 per ton; 1934 cottonseed meal, $26.00 per ton; 1935. cottonseed meal $25.00 per ton.

FIGURE 1—LOT 1, GRADE HEREFORD STEERS, 1935, RECEIVED 5 POUNDS

Jersey or "Yellow Hammer" Steers Showed Little Effect of Supplementary Feeding; Best Marketed Early

Seventy-two Jersey steers, locally known as "Yellow Hammers", were used in the 1933 trial. They were purchased in the fall of 1932, fed about 15 pounds sorghum silage, ½ pound meal and 7 pounds Johnson grass per steer per day through the winter and turned on pasture around April 1. Most of these steers were thin, but were in thrifty condition when purchased. They made a slight increase in live weight during the wintering period in spite of the fact that they were dehorned in December and did not have access to shelter during the wintering period.

In this experiment, comparisons were made of the feeding of cottonseed cake at the rate of 5 pounds per head per day in addition to pasturage to one lot; of 2½ pounds of cottonseed cake per head per day in addition to pasturage to the second lot; and of pasturage alone for the third lot. In addition, comparisons were made of lengths of feeding and grazing periods so that three lots of 12 steers each were so handled, fed, and grazed from April 20 to August 11 and marketed at the end of 113 days; and three additional lots of 12 steers each were so fed, handled and grazed from April 20 to October 3, a period of 166 days.

The results of the 1933 experiments are given in Tables 1 and 2 as follows:

TABLE 1—1933 RESULTS: SHORT PERIOD* FEEDING AND GRAZING JERSEY STEERS

	Lot 1 5 lbs. c s cake	Lot 2 2½ lbs. c s cake	Lot 3 Pasture only
No. Steers per lot	12	12	12
Average initial wt.—lbs.	515.5	507.6	501.2
Average final wt.—lbs.	735.0	721.2	717.1
Total gain per steer—lbs.	219.5	213.6	215.9
Average daily gain—lbs.	1.93	1.89	1.91
Supplement required per 100 lbs. gain—lbs.	257.4	132.2	....
Shrink in marketing—per cent	6.1	5.12	5.31
Selling price per 100 lbs.—dollars	3.00	3.10	2.90
Return per steer above cost of shipping, selling, and supplemental feed	10.52	14.51	15.66

*Feeding and Grazing Period April 20, 1933 to August 11, 1933; 113 days.

TABLE 2—1933 RESULTS: LONG PERIOD* FEEDING AND GRAZING JERSEY STEERS

	Lot 1 A 5 lbs c s cake	Lot 2 A 2½ lbs. c s cake	Lot 3 A pasture only
No. steers per lot	12	12	12
Average initial wt.—lbs.	491.1	489.0	501.2
Average final wt.—lbs.	793.3	795.8	787.9
Total gain per steer—lbs.	302.2	306.8	286.7
Average daily gain—lbs.	1.82	1.84	1.72
Supplement required per 100 lbs. gain—lbs.	274.6	135.2	.....
Shrink in marketing	4.79	5.98	5.20
Selling price per 100 lbs.—dollars	2.67	2.62	2.58
Return per steer above cost of shipping, selling and supplemental feed	8.36	11.73	13.62

*Feeding and Grazing Period April 20, 1933 to October 3, 1933, 166 days.

By referring to the above tables it will be noted that there was but little difference in the total and daily gains made by the steers in the three lots. Neither was there any significant difference in the selling price per 100 pounds live weight. The returns per steer above the cost of shipping, selling, and supplemental feed was decidedly in favor of the steers that received no supplemental feed. Lot 2, which had been fed the light cake ration, showed slightly reduced returns per steer, when compared with the lot receiving pasture only while least returns were had from the heavy cake-fed steers.

Short Period Most Profitable

The short feeding and grazing period proved most profitable in this experiment. Reference to the tables will reveal that returns per steer above the cost of shipping, selling, and supplemental feed were highest for the short fed and grazed lots when directly compared; that is, Lot 1, receiving 5 pounds cottonseed cake per steer daily during the short period returned more money above these costs than did an equal number of steers in Lot 1 fed over the long period. Lot 2, fed 2½ pounds cake per steer per day returned more during the short period than did Lot 2A fed the same supplement over the longer period. Lot 3, in which the steers received pasture alone, yielded the largest net returns of any of the three short fed or three long fed lots.

Higher prices prevailing at the time the short fed and grazed lots were marketed account for the higher returns from the short period lots. Prices per hundred-weight of beef animals are usually higher in August than in October

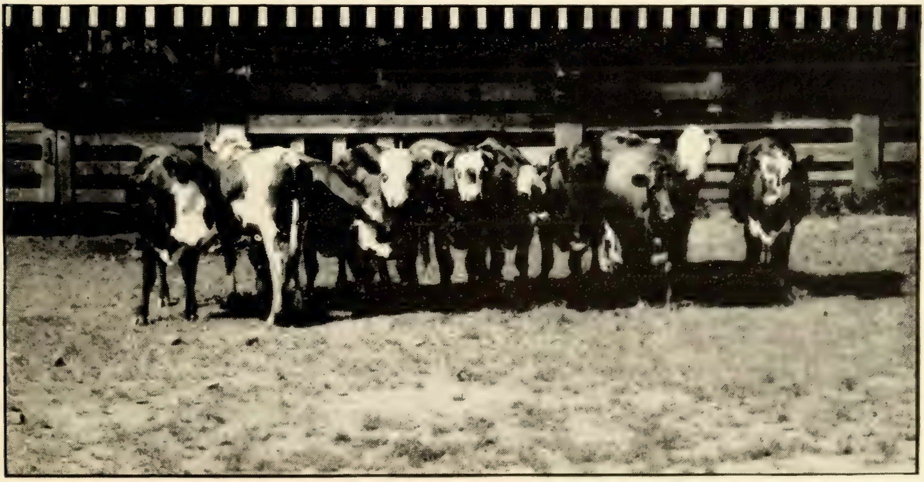

FIGURE 2—LOT 2, GRADE HEREFORD STEERS, 1935, RECEIVED 2½ POUNDS COTTONSEED MEAL DAILY

First-Cross Steers Gain More When Fed Supplement, But Increased Value Exceeded by Cost

Thirty first cross steers, two-years old and of poor quality and conformation, were used in the 1934 experiment and were equalized and divided into three lots and fed and handled as in the preceeding experiment. These steers were practically all first crosses from native or Jersey cows and sired by an Angus bull. They were produced on a farm located about eight miles from the Experiment Station. The feeding and grazing period extended from May 2 to August 21, a period of 121 days. On the latter date, the thirty steers were weighed and disposed of through the College Cafeteria. Prior to sale they were graded individually as slaughter cattle by a Committee of three members of the Animal Husbandry Department. Weights on individual carcasses were obtained and dressing percentages were determined.

On account of the local disposition of the steers at the end of the trial period, exact market values were not obtainable for each of the three lots. Reference to the grades of steers at the end of the grazing period, as shown in the foregoing table 3, reveals little if any significant difference which would be reflected in price. One steer in the lot fed 5 pounds of cottonseed meal daily rated "Choice." None graded "Choice" in either lots 2 or 3. One steer graded 'Good" in lot 1, three in lot 2, five in lot 3. Eight steers graded "Medium" in lot 1, seven in lot 2, five in lot 3. Slightly higher total gains and daily gains were made by steers fed cottonseed meal in addition to pasturage, but the market value of such gains was not sufficient to cover the cost of supplemental feed used.

TABLE 3—1934 RESULTS: FEEDING AND GRAZING* FIRST CROSS STEERS

	Lot 1 5 lbs. c s meal	Lot 2 2½ lbs. c s meal	Lot 3 Pasture only
Number of steers per lot	10	10	10
Average initial wt.—lbs.	702.5	701.0	701.5
Average final wt.—lbs.	923.5	921.0	909.0
Total gain per steer—lbs.	221.0	220.0	207.5
Average daily gain—lbs.	1.82	1.81	1.71
Supplement required per 100 lbs. gain—lbs.	273.7	137.5	......
Grading of steers at end of grazing period:			
Choice	1	......	......
Good	1	3	5
Medium	8	7	5
Dressing per cent	54.5	54.4	53.9

*Feeding and Grazing Period May 2 to August 31, 121 days.

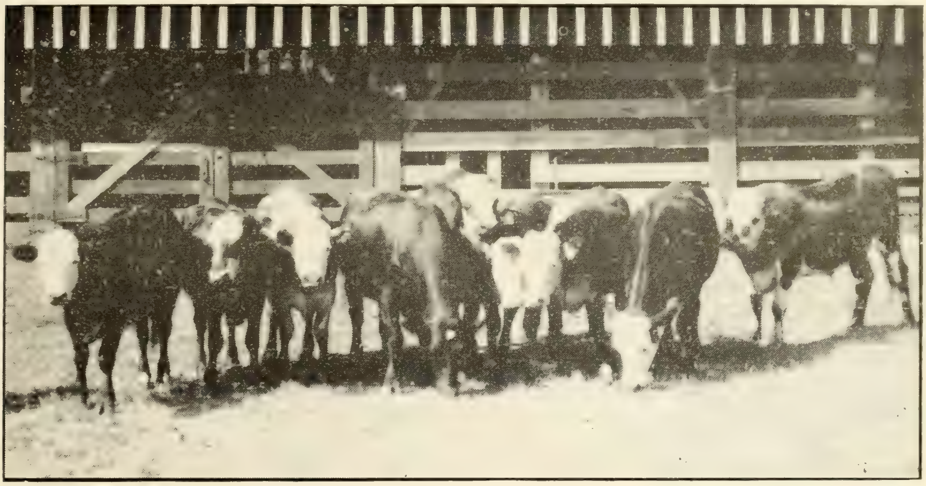

FIGURE 3—LOT 3, GRADE HEREFORD STEERS, 1935, RECEIVED PASTURE ONLY

Good Grade Hereford Steers Fed 5 Pounds Meal Daily Gain Most, Worth Most, But Did Not Net Most

The steers used in the 1935 experiment were two-year old grade Herefords, including a few cross breds. They were purchased in the fall of 1934 about 20 miles from the College and "roughed" through the winter on Johnson grass hay which was fed under a shelter. These steers showed more evidence of beef breeding than either of the previous groups.

The feeding and gazing period in 1935 was started April 16 and ended August 26 a period of 133 days. At the latter date, they were shipped to East St Louis for sale, and selling and slaughering records were secured. The steers were divided into lots at the National Stock Yards according to the way they had been handled during the experiment, and separate appraisals were made of lot 1, lot 2, and lot 3 by the packer buyers.

The results of the 1935 experiment are reported in the following table.

TABLE 4— 1935 RESULTS: FEEDING AND GRAZING* GOOD GRADE HEREFORD STEERS

	Lot 1 5 lbs. c s meal	Lot 2 2½ lbs. c s meal	Lot 3 Pasture only
No. steers per lot	10	10	10
Average initial wt.—lbs.	673.0	680.5	677.0
Average final wt.—lbs.	941.5	910.5	901.7
Total gain per steer—lbs.	268.5	230.0	224.7
Average Daily gain per steer—lbs.	2.02	1.73	1.69
Supplement required per 100 lbs. gain—lbs.	247.7	144.5	......
Shrink per cent	4.8	5.5	5.0
Dressing per cent (market wt.)	58.3	57.9	58.1
Selling price per 100 lbs.—dollars	7.85	7.00	7.60
Returns per steer above cost of supplement, shipping and selling	56.86	51.06	60.09

*Feeding and Grazing Period, April 16, 1935 to August 26, 1935; 133 days.

It will be noted from the table (4) that the steers fed 5 pounds of cottonseed meal per day made .29 pounds more daily gain per steer than the steers fed the light meal ration, and sold for 85c more per 100 pounds live weight. The steers fed 2½ pounds cottonseed meal per day made practically the same rate of gain as the steers receiving pasture only, and were appraised at 60c less per 100 pounds live weight. Notwithstanding these higher total and daily gains made by steers receiving the supplementary feed, more money was received in returns per steer above the cost of supplement, shipping, and selling, from lot 3 which received pasturage only.

While not within the scope of this experiment, it is suggested that returns from the supplementary feeding of cottonseed meal or cake may have been minimized by the sufficiency and quality of grazing furnished by the pasture used. Under conditions where pasturage is not sufficient for maximum "grass fat" growth, it seems likely that the feeding of cottonseed meal or cake as a supplement to pasturage might be more favorably reflected in increased daily gains, better finish, and enhanced market value per 100 pounds live weight.

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A Compilation of Experimental Information on

Feeding

LAYING HENS

by

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Coordinator Research Information
Jointly Representing
Mississippi Agricultural Experiment Station
and
Mississippi State Vocational Board

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INTRODUCTION

In this compilation dealing with "Feeding Laying Hens", an attempt has been made to cover the job as thoroughly as possible. First, a general discussion of feed requirements for laying hens is presented. Second, experimental information is presented to answer questions about feeding laying hens. This information is divided into sections.

First Section. Proteins are taken up in this section, and an attempt has been made to show the amount of protein necessary, the sources of protein, the effect of different sources and amounts of protein on the hen and the quality of the egg.

Second Section. The subject of vitamins and their importance to the hen has been taken up to show their value and how they affect the egg production of the hen.

Third Section. Minerals in the hen's ration are very important and in this section information on the source of minerals and their effect on the laying hen has been presented.

Fourth Section. The matter of feeding different types of rations has been taken up trying to show what type rations a hen should receive.

Fifth Section. The housing conditions on the average Mississippi farm are poor and in this section an attempt has been made to show the value of using lights in connection with feeding hens and the type of house necessary to use this system of feeding.

Sixth Section. The matter of range or pasture with poultry is very important. Information on the advantages of supplying poultry with grazing crops as compared to clean yards has been presented in this section.

Seventh Section. Information has been presented here to show the effect of age on egg production of hens, to answer the question, how long a hen should be kept in a flock.

Eighth Section. In this section an attempt has been made to show the feed consumption of the various breeds of chickens.

This bulletin, "Feeding Laying Hens" was started by Mr. E. E. Gross in November 1938, Coordinator Research Information at that time.

The very helpful and constructive suggestions and criticisms offered by Mr. G. R. Sipe of the Poultry Department, Mr. V. G. Martin and staff of the Agricultural Education Department were very helpful in preparing this bulletin. This cooperation is appreciated.

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General Requirements for Feeding Laying Hens

The problem of feeding laying hens is of vital importance to the farmers of Mississippi. The production from poultry is relatively low. What causes the low production we have from poultry? Do the feeding practices followed have a direct bearing on the production? According to the Bureau of Agricultural Economics the estimated egg production per hen in Mississippi is approximately 60 eggs per year. There are records of hens that produce well over 300 eggs per year. What causes this wide variation of egg production?

On the average farm of Mississippi the laying hen gets a ration of corn and scraps that may be picked up. In following this practice, is any consideration given to the feed requirements of the laying hen? In most cases for a hen to produce eggs as she should sufficient feed material must be provided for body maintenance and egg production. Nature will see that the body requirements are taken care of first and what is left will go to the production of the egg. The feed elements needed by the laying hen are protein, carbohydrates, fat, minerals and vitamins. With the feeding practice as it is on the average farm it is easy to see why the laying hen does not receive a balanced ration, especially at certain periods of the year.

Protein is very important, the hen's body contains over 20% protein and the egg 14%, in the laying hen's ration for maintenance of the body and to produce the eggs. As already stated corn is the most extensively used protein feed in Mississippi. It is very low in protein, containing 7.5%. It is easy to see why corn alone will fail to meet the protein requirements of the laying hen. Corn is produced on practically all Mississippi farms which may explain why corn is used so extensively in feeding laying hens.

Cottonseed meal is produced on most Mississippi farms and is rich in protein, containing over 40%, slightly less than meat scraps. For the last few years cottonseed meal has been relatively cheap, averaging about $1.35 per 100 pounds while meat scraps, beef scraps and tankage are considerably higher. The use of cottonseed meal as a supplement in a laying hen's ration will meet the protein requirements, but care should be exercised in the use of cottonseed meal as large quantities are harmful to the hen and affects the quality of the egg.

In certain areas of the state the production of oats as a feed crop is increasing a great deal. Oats are somewhat higher in protein content than corn and might be used as a supplement in the poultry ration in place of part of the corn thereby giving a wider variety in the hen's ration.

Milk in some form is very important to laying hens. On a number of farms whole milk is being sold without any consideration as to the value of skimmilk to livestock and poultry. By separating the whole milk in many cases a large supply of skimmilk would be made available for livestock and poultry, which gives another source of protein, and supplies two of the most important vitamins.

In most cases the fat and carbohydrates feed elements are supplied in sufficient quantities to meet the needs of the hen. Corn is especially high in carbohydrates and contains some fat.

The highest egg production is during the spring and early summer months. This is partly due no doubt to the supply of succulent green material available to the hen during this period. Green grasses are known to contain large quantities of certain vitamins which are very important to the hen.

Vitamin deficiency does not seem to affect the mature hen as much as it does the young chick; however, vitamin A deficiency does affect the egg production. A deficiency of vitamins A and G, especially, effects the hatchability and the type of chick produced.

Another constituent which is very important in the hen's ration is mineral. This element makes up approximately 4% of the hen's body. It is very important in the proper development of the bones and seems to have an important function in digesting proteins. Minerals are very important in producing the egg. An egg contains approximately 12% mineral. This element can not be supplied in sufficient quantities in an all grain ration. The grain feeds contain some mineral, but to get a sufficient quantity additional amounts must be added.

It can be seen that each element has a direct function in the hen's ration and to get a profitable egg production these elements must be supplied in sufficient quantities.

Daily Feed Requirements for Laying Hens for Each 100 Pounds of Live Weight

Individual Weight	Pounds Digestible Nutrients				Total Dry Matter	Calories	Nutritive Ratio
	Protein	Fat	Carbohydrates	Ash			
5-8 pounds	.65	.20	2.75	.20	3.3	6,240	1-4.2
3-5 pounds	1.00	.35	3.75	.30	5.4	10,300	1-4.6

Reference: Poultry Enterprise by Sherman Dickinson and Harry R. Lewis, page 171.

PROTEIN—What it is, its use, and protein feeds produced in Mississippi suitable for feeding poultry.

What are proteins?

Proteins are nitrogen-bearing compounds composed of carbon, hydrogen oxygen, and sometimes sulfur, phosphorous and iron—a group of nutrients essential to animal life. Proteins vary widely in composition. There are many thousands of different proteins, all of which, however may very probably be broken down by chemical methods to amino acids (about twenty). Certain of these amino acids are referred to as essential, and unless proteins contain these essential amino acids they are "incomplete" and will not serve the purposes of the bird completely. One reason why poultrymen should feed a variety of feeds is that a variety of proteins is necessary in order to insure a sufficient amount of essential amino acids.

How does the hen use protein?

First, protein is used to maintain the body. The body must be supported before the hen will produce very many eggs. A large part of the feed consumed by a hen goes for maintenance of the body. A hen that is in normal production of eggs uses about two-thirds of the required feed for maintenance of the body. Protein is especially a source of energy to the hen. The hen's body contains over 55% water, over 20% protein, nearly 20% fat, and about 4% minerals. Therefore protein is a very important feed element in supporting the body.

Secondly, protein is used in the production of eggs. If the hen is to produce eggs as she should there must be an added amount of protein in addition to the body requirement. The egg contains 65% water, 14% protein, 10% fat, and 11% mineral. Again protein is a very vital food element in the production of the egg.

What protein feeds are produced on the farms of Mississippi that are suitable to use in feeding laying hens?

As stated in the general discussion corn is the main feed used in feeding hens on the average farm.

Will corn alone supply the protein requirement of a laying hen?

Is corn a cheap protein feed?

It has been pointed out that cottonseed meal is available in Mississippi, and has a high protein content.

Will cottonseed meal supply the necessary protein in the hen's ration?

Does cottonseed meal have any harmful effects on hens?

With cottonseed meal at $1.35 per 100 pounds and meat scraps and tankage at $3.00 to $3.50 per 100 pounds, can a person feeding laying hens afford to feed cottonseed meal as the only source of protein after considering the cost of different sources?

Is skimmilk a satisfactory protein supplement?

What sources of protein should be used in feeding laying hens?

How much protein should a laying hen get?

The Influence of Various Protein Concentrates on Egg Production

Conducted by: Missouri Agricultural Experiment Station.

Conducted at: Columbia, Missouri.

Purpose: To study the effect of various protein concentrates on egg production.

Procedure and Conditions: The hens have been housed in a special house consisting of eight pens. Each pen is 12′ x 14′, is equipped with trap nests and is provided with a yard 24′ x 100′.

With the exception of the year 1927-28 when White Leghorn pullets were used, White Leghorn hens were used in the feeding tests. The basis of selection of these birds and their distribution was the previous trap nest record of the bird. It was thought that this gave a more uniform selection than the use of pullets would make possible.

Throughout the experiments a combination of grain and laying mash has been fed. The grain which constituted approximately two-thirds of the ration consisted of 2 parts, by weight, of yellow corn and 1 part oats. Any changes made in the scratch feed was made in all pens at the same time, the only variable part of the ration being the type of mash fed. The mashes varied in the type of protein concentrate, the use of mineral supplements when vegetable protein concentrates were used, and the type of mineral supplement. The basal mash consisted of equal parts, by weight, of bran, shorts, and yellow corn meal.

From November 1 to April 1 a small amount of grain was fed in the morning at the rate of 3 to 5 pounds per 100 hens. For the remainder of the year no morning scratch grain was fed. At night the hens were given all the grain they would consume. This was fed just before the birds went to roost. During winter the amount fed at the night feeding was approximately 10 pounds per 100 hens, while in summer it was probably not more than 7 or 8 pounds. The changing quantities of grain fed depended upon the season of the year and the appetites of the hens.

The mash was fed dry and was kept in open reel hoppers before the hens all the time. Once daily at noon a crumbly wet mash was fed.

All pens had access to hoppers containing limestone rock and oyster shell.

The composition of the mashes used in the feeding experiments is as follows:

Percent in Pounds

Ration No.	401	404	407	408	409	410
Bran	22	22	26	26	26	21
Shorts	22	22	26	26	26	21
Cornmeal	22	22	26	26	26	21
Cottonseed meal	30					
Soybean meal		30				
Meat scrap			20			
Tankage				20		
Fish meal					20	
Dried butter milk						35
Bone meal	4	4				
Salt	1	1	1	1	1	1

In the test with dried buttermilk Ration 410 was used.

Ration 407 was used in the commercial meat scrap test.

When tankage was used as the protein, Ration 408 was used.

Fish meal was the source of protein when Ration 409 was used.

Ration 401 was used when cottonseed meal was the source of protein.

In the test with soybean meal, Ration 404 was used.

Results: The Effect of Various Protein Concentrates on Egg Production

	Dried Buttermilk + 410	Meat Scraps + 407	Tankage + 408	Fish Meal + 409	Cottonseed Meal + 401	Soybean Meal Supplemented with Corn Meal & Salt
	5 Yr. Av.	5 Yr. Av.	5 Yr. Av.	3 Yr. Av.	5 Yr. Av.	5 Yr. Av.
Grain	51	55	55	51.6	49.	49.
Mash	26	25.4	23	20.	21.	20.
Eggs	148	133	120	108	133	129
Lbs. feed to produce 1 doz. eggs	6.39	7.33	7.88	7.84	6.3	6.17

Reference: Missouri Agricultural Experiment Station Bulletin 288, "The Influence of Various Protein Concentrates on Egg Production", pages 3, 4, 5, 6, 7, 8, 9, and 11, tables 1, 3, 4, 5, 6, 8, and 11, August 1930, Columbia, Missouri.

Skimmilk versus Meat Scraps as Supplements to Cottonseed Meal

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson, South Carolina.

Period: Two years: November 1, 1928 to October 15, 1929
November 1, 1929 to October 15, 1930.

Purpose: To compare skimmilk with meat scraps as supplementary proteins to cottonseed meal upon (1) egg production and (2) fertility and hatchability of eggs.

Procedure and Conditions: Each pen consisted of 25 yearling Single Comb White Leghorn hens which were negative to pullorum infection.

All pens were housed in shed-roof open front houses. Lots adjacent to the houses were seeded in a succession of green crops for the birds throughout the year. Two lots were available for each pen. Birds were allowed free range throughout the experiment. Water and oyster shell were available in all pens at all times. Mash was self-fed in hoppers. Grain was fed morning and evening.

Feed and egg records were kept on a pen basis. Averages were figured on a hen day basis for the actual number of hens in each pen. Eggs for hatching were gathered, stored, and incubated under identical conditions. Two cockerels were used in each pen during the breeding season. Males were changed twice each week to eliminate any variations in fertility and hatchability from this factor. All chick and egg weights on all pens were obtained at the same time under similar conditions.

The grain ration for the pens consisted of shelled yellow corn two parts and wheat one part. Germinated oats at the rate of two pounds per 100 birds were fed daily at noon during the winter months. Mash mixtures were as follows:

	Pen 2 Pounds	Pen 5 Pounds
Ground yellow corn	200	200
Wheat middlings	200	200
Meat scraps	50	—
Cottonseed meal	50	50
Salt	5	4.5
Mineral mixture	10	10

Note: Mineral mixture consisted of bone meal 60 parts, oyster shell meal 20 parts, and salt 20 parts.

Pen 5 was fed skimmilk at the rate of two gallons per 100 hens daily.

Results: Egg Production Per Hen and Feed Consumed Per Hen

Pen Number	Egg Production Per Hen			Feed Consumed Per Hen		
				Average 2 Years		
	First Year	Second Year	2 Year Average	Grain	Mash	Milk
	Eggs	Eggs	Eggs	Pounds	Pounds	Gallons
2	135.6	154.5	145.0	30.1	38.5	
5	127.0	163.6	145.3	30.3	35.8	6.9

During the 2 years 96.2% of the eggs produced by pen 2 were fertile while 70.4% were hatchable. In pen 5, 88.8% of the eggs were fertile and 58.0% were hatchable.

Reference: South Carolina Agricultural Experiment Station Bulletin 273, "Poultry Feeding Experiments", pages 5, 11, 12 and 13, tables 10, 11, 12 and 14, June 1931, Clemson, South Carolina.

Ground Soybeans as a Protein Supplement for Laying Hens

Conducted by: Delaware Agricultural Experiment Station.

Conducted at: Newark, Delaware.

Period: Three years, November 1, 1928 through September 11, 1931.

Purpose: To determine to what extent ground soybeans can be used as the protein supplement in rations for laying hens.

Procedure and Conditions: The birds used in the experiments were reared on the Station poultry farm. The basis of selection of birds and their distribution was based upon weight and general appearance.

The birds were housed in 10′ x 20′ laying pens and kept confined to the laying pens throughout the experiment.

No culls were removed from the pens during the experiment. Only dead birds, or birds so near death that there was no hope of recovery, were removed from the laying pens.

The rations were fed as all-mash. Mash was kept before the laying birds in open hoppers at all times.

Germinated oats were fed in all pens at the rate of approximately 4 pounds per 100 birds. Oyster shell and limestone grit was available in hoppers at all times.

Experiment 1—November 1, 1928 through September 15, 1929

Six pens of 50 pullets each were selected on October 15, 1928 and placed in the experimental laying house. The period from October 15 to November 1 allowed the birds to become accustomed to the laying house and to the experimental rations.

During the winter, lights were used to give a 12-13 hour day. Eggs laid on the first and fifteenth day of each month were weighed and these weights were used to indicate the weight of eggs laid during the experiment. The mash hoppers were filled once daily at 3 P. M.

Pen 1 served as the check lot and meat scraps and dried buttermilk were used as the protein supplements. In pen 2 one-third of the meat scraps was removed, and ground soybeans were substituted for the meat scraps in such amount as to give practically the same protein content as the check ration. In pen 3 two-thirds of the meat scraps were replaced by ground soybeans, and in pen 4 all the meat scraps were replaced by ground soybeans. In pen 5 the dried buttermilk was replaced by ground soybeans and in pen 6 both the meat scraps and dried buttermilk were replaced by ground soybeans. The protein content of the six laying rations range from 15.4 per cent to 15.7 per cent. Bone meal was used to maintain the ash content of the rations when ground soybeans were used as the protein supplement in place of the meat scraps.

Experiment 2—October 7, 1929 through August 7, 1930

Ten pens of 50 pullets each were selected on September 24, 1929 to continue the study of the value of ground soybeans in the laying ration. Pens 1, 3 and 4, 7, 8, and 11 were duplicates of pens 1, 2, 3, 5 and 6 respectively of the 1928-29 experiment. Pen 1 again being the check pen. As there had been a decided reduction in eggs produced when the amount of ground soybeans in the laying ration was increased from 5.4 to 10.4 per cent, the rations for pens 5, 6, and 9 formulated to contain ground soybean percentages ranging between 5.4 per cent and 10.4 per cent. In Ration 10 the quantity of dried buttermilk was doubled, and ground soybeans were added to give a protein analysis comparable to the check pen. This ration contained 13.3 per cent of ground soybeans. In Ration 2 the meat scraps was increased 1 per cent as compared with Ration 3, but the percentage of soybeans remained the same as in Ration 3.

Experiment 3—September 13, 1930 through September 11, 1931

Seven pens of 50 pullets each were selected on September 12, 1930 to continue the study of the value of ground soybeans in the laying ration. In the two previous experiments egg production results from 13 per cent or more of ground soybeans in the laying ration had been very unsatisfactory. For this reason the percentage of soybeans in Experiment 3 did not exceed 10.4 per cent in any ration.

Pens 1 to 6 inclusive were duplicate of pens 1, 3 and 4, 5, 6, 7, and 9 respectively of the 1929-30 experiment. Pen 7 was fed a ration in which 300 pounds of cracked wheat was substituted for 300 pounds of ground corn.

The change to the experimental rations was made gradually during the first 15 days of the experiment. This change did not appear to affect the birds as the egg production in the 7 experimental pens during the first three weeks of the experiment was very uniform.

The table that follows gives the rations fed during the 1930-31 test. The rations the other two years were very much the same.

Composition of Laying Rations, 1930-1931

Ingredients	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6	Pen 7
Ground yellow corn	44.2	42.6	42.0	41.6	41.2	43.0	15.5
Cracked wheat	16.3	15.7	15.5	15.4	15.1	15.9	42.0
Wheat bran	9.3	9.0	8.9	8.7	8.6	9.0	8.9
Flour wheat middlings	9.3	9.0	8.9	8.7	8.6	9.0	8.9
Meat scraps (55%)	8.4	5.4	4.4	3.5	2.6	5.4	4.4
Dried buttermilk	2.3	2.2	2.2	2.2	2.2		2.2
Ground soybeans		5.4	7.1	8.7	10.4	6.8	7.1
Alfalfa leaf meal	4.6	4.5	4.4	4.6	4.3	4.5	4.4
Bone meal	2.3	3.0	3.4	3.5	3.9	3.2	3.4
Limestone flour	1.8	1.8	1.8	1.7	1.7	1.8	1.8
Salt	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Cod liver oil	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percentage of protein	15.4	15.4	15.5	15.5	15.5	15.4	15.5
Percentage of fat	4.3	5.0	5.2	5.3	5.5	5.3	5.2
Percentage of fibre	3.5	3.5	3.6	3.6	3.7	3.6	3.6
Percentage of ash	7.3	7.5	7.6	7.4	7.6	7.4	7.6

Results: Effect of Varying Amounts of Soybean Meal in the Ration of Laying Hens

Percentage of soybeans in ration	0.0	1.4	5.4	6.8	7.1	8.7	10.4	13.3	15.0	16.8
Number of trials	2	2	4	2	3	2	3	1	1	2
Av. length of trial (days)	329	308	323	334	324	334	329	304	319	308
Av. number of eggs per pullet	152.4	133.2	133.6	132.7	126.5	126.1	112.1	121.0	107.7	104.2
Percentage of production as compared with the check ration	100.0	87.4	87.7	87.1	83.0	82.7	73.5	79.4	70.7	68.4
Av. pounds of feed required per dozen eggs	6.5	6.8	7.1	7.1	7.5	7.7	8.5	7.8	8.9	8.8
Av. per cent mortality	23.3	15.0	28.0	27.0	27.3	40.0	31.3	38.0	20.0	19.0
Percentage of mortality due to prolapse	2.7	0.0	5.0	2.0	5.3	9.0	8.0	10.0	0.0	7.0

Reference: Delaware Agricultural Experiment Station Bulletin 197, "Ground Soybeans As A Protein Supplement for Laying Birds", pages 6, 8, 9, 12, 13 and 20, tables 6 and 14, February 1936, Newark, Delaware.

The Relative Value of Cottonseed Meal and Tankage for Egg Production

Conducted by: New Mexico Agricultural Experiment Station.

Conducted at: State College, New Mexico.

Period: Four years, 1925-1929.

Purpose: To determine the relative value of cottonseed meal and tankage for egg production.

Procedure and Conditions: The pens used in this experiment each contained twenty Single Comb White Leghorn pullets. These pullets were selected from the stock raised at the experimental plant. They were of similar age and breeding and had received the same feed and care up to the time the experiment commenced. When the pullets were divided into pens, precautions were taken to insure the quality of the birds in each pen being as nearly equal as possible.

The pens were divided into two groups of four each. One group was given an alfalfa range; the other was kept on bare yards which were devoid of green plants. The rations used for the second group were duplicated in the kind of range they were allowed.

The pens in the second group were given a small amount of green feed, mostly in the form of sprouted grains. This supply of green feed was irregular and of limited quantity, not being more than most birds would receive in most of the dry-land sections of New Mexico. In these pens a few cases of nutritional roup developed indicating that there was a vitamin A deficiency in the ration.

The mash fed was as follows:

	Pens on alfalfa range				Pens on barren yards			
	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6	Pen 7	Pen 8
Mash	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Wheat bran	100	100	100	100	100	100	100	100
Ground oats	100	100	100	100	100	100	100	100
Corn meal	100	100	100	100	100	100	100	100
Tankage	91.5	80	61.5	—	91.5	80	61.5	—
Cottonseed meal, 43% protein	—	20	61.5	188	—	20	61.5	188
Salt	6	6	6	6	6	6	6	6
Total weight of mash	397.5	406	429	494	397.5	406	429	494

All pens received a scratch ration composed of 100 pounds wheat, 150 pounds milo, 50 pounds ground corn and 50 pounds rolled barley.

Results: Average Annual Egg Production Per Hen for the Four Years the Experiment Was in Progress

Percentage of Protein Supplement in the Mash	First Year 1925-1926		Second Year 1926-1927		Third Year 1927-1928		Fourth Year 1928-1929		Average of four Years	
	Alfalfa Range	Barren Range	Alfalfa Range	Barren Range	Alfalfa Range	Barren Range	Alfalfa Range	Barren Range	Alfalfa Range	Barren Range
Tankage, 23% Cottonseed meal, none	179.0	134.0	183.0	129.0	191.0	159.0	157.0	117.0	177.5	134.8
Tankage, 20% Cottonseed meal, 5%	172.0	128.0	155.0	148.0	194.0	170.0	136.0	134.0	164.2	145.0
Tankage, 15% Cottonseed meal, 15%	181.0	132.0	167.0	145.0	197.0	169.0	153.0	134.0	174.5	145.0
Tankage, none Cottonseed meal, 38%	177.0	118.0	138.0	112.0	172.0	166.0			162.3	132.0
Average	177.3	128.0	160.8	133.5	188.5	166.0	148.7	128.3	169.6	139.2

It will be noted that cottonseed meal has some effect upon the quality of the egg. In pen 1, fed no cottonseed meal, the average egg weight before experimental feeding began was 50.7 grams while 3½ months after experimental feeding began the average egg weight was 54.8 grams. The average egg weight before experimental feeding began for pen 4, fed cottonseed meal, was 51.5 grams and only 43.8 grams 3½ months after experimental feeding began.

The following tabulation shows the effect of a cottonseed meal ration on the hatchability of eggs.

Pen	Eggs Incubated	Number of Infertile Eggs	Number of Dead Germs	Number of Chicks Hatched	Per cent Hatch of Fertile Eggs
1	234	27	56	151	72.9
4	167	19	82	63	42.6

Reference: New Mexico Agricultural Experiment Station Bulletin 183, "The Relative Value of Cottonseed Meal and Tankage for Egg Production", pages 4, 5, 11, 13, and 16, tables 1, 6, 7, and 9, May 1930, State College, New Mexico.

The Effect of Cottonseed Meal, Beef Scraps, and Skimmilk as a Protein Feed for Laying Hens

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: 8 months, 1920 and 1921.

Purpose: To determine the value of skimmilk or buttermilk for laying hens.

Procedure and Conditions: Four pens (16 to the pen) of White Leghorn pullets, equal in production, as well as could be judged, were used.

Each pen had a mixed grain twice per day and dry mash before them at all times.

Pen No. 13 was fed a mash composed of equal parts by weight of corn meal, wheat bran, wheat shorts, and cotton seed meal. Cotton seed meal being the protein for this pen.

Pen No. 14 had the same as 13 except beef scrap was substituted for cotton seed meal.

Pen No. 15 had the same as 13 and 14 except milk (all they could drink) was substituted for the protein.

Pen No. 16 was the same as 13, 14 and 15, except no protein was used. This was the check pen.

Results: **Comparison of Cottonseed Meal, Beef Scraps and Skimmed Milk As A Protein Feed for Laying Hens**

	Pen 13	Pen 14	Pen 15	Pen 16
Number of hens	15	16	14	16
Total feed consumed (pounds)	614	649	509	510
Total milk consumed (pounds)	000	000	1524	000
Total pounds crude protein	110	133	145	75
Eggs per hen	88	99	123	56

Reference: Mississippi Agricultural Experiment Station Bulletin 204, "1920 and 1921 Experiments with Poultry", page 5, table 3, December 1921, State College, Mississippi.

Protein Supplement for Laying Hens

Conducted by: Washington Agricultural Experiment Station.

Conducted at: Pullman, Washington.

Purpose: To study the effect of Alaska herring fish meal and various combinations of this meal, meat scrap, dried skim milk, and soybean oil meal as protein supplements for laying hens.

Procedure and Conditions: Four hundred and eighty mature Single Comb White Leghorn pullets were carefully selected and divided into eight groups of 60 birds each. Care was exercised to place birds of similar weight and sexual development in each pen. The birds were confined in pens 14 by 20 feet.

A basal ration composed of the following ingredients was used:

Mill run	18.0 pounds
Wheat middlings	10.0 pounds
Ground yellow corn	20.0 pounds
Ground heavy oats	15.0 pounds
Ground barley	15.0 pounds
Ground white wheat	15.0 pounds
Dehydrated alfalfa	7.0 pounds
	100.0 pounds

Enough of the basal mixture was prepared previous to starting the experiment to last for the first six months. This mixture contained 12.0 per cent protein, 0.28 per cent calcium, and 0.52 per cent phosphorus. Near the end of the first six months a second basal mixture was made to complete the experiment which analyzed 13.2 per cent protein, 0.21 per cent calcium, and 0.37 per cent phosphorus.

Proportion of Basal Mixture, Protein Supplements, Bone Meal, Oyster Shell Flour, Salt, and Cod Liver Oil Used in Formulating the Rations

	Ration 1	Ration 2	Ration 3	Ration 4	Ration 5	Ration 6	Ration 7	Ration 8
	Fish	Fish and soybean	Fish and milk	Fish and meat	Fish meat & milk	Milk and meat	Meat and soybean	Milk and soybean
Ingredients	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
FIRST MIX								
Basal mixture	87.21	84.22	81.88	86.75	84.44	81.26	83.64	78.11
Herring fish meal	7.73	4.11	4.32	3.92	4.11	—	—	—
Soybean oil meal	—	6.34	—	—	—	—	6.43	7.13
Dried skimmilk	—	—	8.77	—	4.17	8.91	—	9.39
Meat scrap	—	—	—	4.41	2.31	4.94	4.70	—
Bone meal	1.47	1.81	1.55	1.06	1.29	1.10	1.38	1.94
Oyster shell flour	3.59	3.52	3.48	3.86	3.68	3.79	3.84	3.43
Salt	.50	.50	.50	.50	.50	.50	.50	.50
Concentrated cod liver oil	.25	.25	.25	.25	.25	.25	.25	.25
TOTAL	100.75	100.75	100.75	100.75	100.75	100.75	100.75	100.75
SECOND MIX								
Basal mixture	88.61	86.26	84.42	88.25	86.44	83.93	83.83	81.37
Herring fish meal	5.91	3.17	3.35	3.00	3.17	—	—	—
Soybean oil meal	—	4.88	—	—	—	—	4.97	5.59
Dried skimmilk	—	—	6.80	—	3.21	6.92	—	7.36
Meat scrap	—	—	—	3.38	1.78	3.84	3.62	—
Bone meal	2.57	2.81	2.58	2.26	2.41	2.22	2.47	2.85
Oyster shell flour	2.90	2.88	2.85	3.11	2.99	3.09	3.11	2.83
Salt	.50	.50	.50	.50	.50	.50	.50	.50
Concentrated cod liver oil	.25	.25	.25	.25	.25	.25	.25	.25
TOTAL	100.75	100.75	100.75	100.75	100.75	100.75	100.75	100.75

The ingredients were mixed as required throughout the experiment and fed as an all-mash. No supplements were added to the ration with the exception of granite grit. Each afternoon the hoppers were allowed to become low in mash so that the remaining mash could be removed and fed as a crumbly moist mash. This was done to encourage feed consumption and prevent the mash in the hoppers from becoming stale.

The Alaskan herring fish meal is commercially prepared from the whole fish by cooking in live steam for 15 to 20 minutes. The oil is pressed from the cooked material and the resulting cake is dried in a rotary hot air drier.

The sample used was secured from several lots in a warehouse where large quantities of the meal were stored. An effort was made not to select a superior product but rather to obtain a composite sample representative of the type of herring fish meal used for feeding purposes in this State.

A 62 percent protein meat scrap was used in this experiment. The dried milk was a commercial sample prepared by the spray process. The soybean oil meal used in this experiment was manufactured in Manchuria. Sufficient quantities of these protein concentrates were secured before the beginning of the trial to last its duration.

Results: Effect of Different Proteins on Laying Hens

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
Factor	Fish	Fish and Soybean	Fish and Milk	Fish and Meat	Fish Meat & Milk	Milk and Meat	Meat and Soybean	Milk and Soybean
Per cent production*	53.6	57.1	53.6	52.5	51.6	51.5	49.5	55.1
Eggs per bird**	170.4	177.4	172.9	166.2	166.5	164.1	154.9	177.3
Av. initial body weight (grams)	1758.5	1730.0	1683.9	1673.2	1651.2	1663.3	1659.0	1682.4
Av. final body wt. (grams)	1782.7	1715.8	1720.4	1643.0	1634.2	1737.0	1646.6	1781.6
Av. body weight for 11 periods (grams)	1728.0	1704.9	1660.0	1621.9	1619.9	1630.7	1630.7	1719.8
Feed consumed per bird (lbs.)	72.47	74.98	70.26	69.39	70.74	71.38	70.06	74.05
Per cent mortality	26.7	15.0	21.7	10.0	25.0	20.0	20.0	25.0

*Per cent production calculated on an exact bird day basis.

**Eggs per bird calculated on the number of birds completing the experiment.

Reference: Washington Agricultural Experiment Station Bulletin 347, "Protein Supplements for Laying Hens", pages 5, 6, 8 and 11, table 4, March 1937, Pullman, Washington.

Milk Feeds as a Source of Protein for Laying Hens

Conducted by: Iowa Agricultural Experiment Station.

Conducted at: Ames, Iowa.

Period: Nine months.

Procedure and Conditions: Eight pens of Single Comb White Leghorn pullets were selected as uniform as possible for line of breeding, date of hatch, and maturity.

Each pen was fed the following basal ration.

Scratch:	200 lbs. cracked corn
	100 lbs. whole wheat
	100 lbs. whole oats
Mash:	100 lbs. ground corn
	100 lbs. ground oats
	100 lbs. middlings
	3 lbs. salt

The following protein supplements were added to the basal ration:

Pen 1. Received no water to drink but liquid in the form of skimmilk.

Pen 2. Liquid buttermilk without water to drink.

Pen 3. Received water to drink and condensed buttermilk paste.

Pen 4. Water to drink but no added animal protein.

Pen 5. Received dried buttermilk in the base mixtures at the rate of 80 lbs. of base mixture to 20 lbs. dried buttermilk.

Pen 6. 60 per cent protein tankage at the rate of 80 pounds of base mixture to 20 pounds tankage.

Pen 7. High protein meat meal was added at the rate of 80 lbs. base mixture to 20 lbs. meat meal.

Pen 8. Received no protein in the base mash but had opportunity to choose either liquid buttermilk or water.

Results:

Pen No.	Average No. Eggs Laid Per Bird
1	111
2	111
3	120
4	37
5	107
6	80
7	102
8	80

Reference: Iowa Agricultural Experiment Station Annual Report for the year ending June 30, 1925, pages 32 and 33, Ames, Iowa.

The Value of Peanuts and Peanut Meal in Rations for Chickens

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: Seven months in 1932-1933
Eleven months in 1933-1934
Six months in 1934-1935

Purpose: To determine the value of whole peanuts, ground peanuts with shells, ground peanuts without shells and peanut meal in farm flock rations for laying hens.

Procedure and Conditions: In each of the three trials of this experiment, 400 pullets were divided into 10 lots of 40 birds each. The pullets were kept in 12 by 14 foot houses and each lot of pullets had access to double yards which supplied seasonal green feeds and limited range.

Single Comb White Leghorns were used in the first two trials while Leghorn-Red Cross bred pullets were used in the third trial.

Feed: The mash ration fed in this experiment, with the exception of those in Lots 2, 3 and 10 were calculated to contain equivalent amounts of crude protein.

All lots except No. 10 were given a basal mash ration (yellow corn meal, bone meal and salt) and whole white corn as a grain ration.

Lot 1 was fed the basal mash ration supplemented with dried skimmilk.

Lot 2 was fed the basal mash ration unsupplemented.

Lots 3, 4, 6, 8 and 10 were fed the basal mash ration and peanut products as the sole protein supplement.

Lots 5, 7, and 9 were fed the basal mash ration and half the protein from skimmilk and half from peanut products.

Lot 10. The mash was excluded in order to test the value of the addition of peanuts to a simple grain ration. The whole yellow corn was substituted for the usual white corn in order to equalize, approximately, amounts of Vitamin A in all lots. Bone meal and salt were fed in unlimited quantities ad libitum.

Oyster shell was supplied ad libitum in all lots.

The birds were weighed individually on the first day of each month during the experiment and individual egg-production records were obtained by the use of trap-nests. Individual weights of eggs laid by each lot every seventh day were averaged to obtain the egg weight for each lot. The fat of a number of yolks from each lot was extracted with ether and its firmness was determined by refractive index readings at 60° C. In order to determine the influence of the rations on mortality, autopsies were made of all birds that died. The birds were mated during the breeding season, and a number of eggs from each lot were incubated to study the effect of the rations on hatchability. The males used in this incubation study were alternated every third day to guard against possible errors in the results due to individual differences among them.

Results: Average Egg Production, Egg Weight, Body Weight, and Hatchability of Egg from Different Lots

Lot No.	Protein Supplement	Average No. Eggs Per Bird Per Month	Average Weight Per Doz. Eggs (oz.)	Average Wt. of Birds (lbs.)	Percentage Hatchability of Fertile Eggs
1.	Skim milk	15.6	22.75	3.87	85
2.	None (corn alone)	6.3	20.79	3.31	62
3.	Whole peanuts ad libitum	7.8	21.43	3.48	75
4.	Ground peanuts with shells	8.0	21.24	3.42	68
5.	Ground peanuts with shells, and skim milk	14.8	22.39	3.67	83
6.	Ground peanuts without shells	9.4	21.55	3.46	51
7.	Ground peanuts without shells, and skim milk	13.9	22.34	3.63	89
8.	Peanut meal	10.7	21.61	3.43	77
9.	Peanut meal and skim milk	13.5	22.28	3.69	86
10.	Whole peanuts and whole corn ad libitum	3.1	21.22	3.18	89

Reference: Alabama Agricultural Experiment Station Circular 80, "The Value of Peanuts and Peanut Meal in Rations for Chickens", pages 3, 4, and 5, table 3, November 1937, Auburn, Alabama.

Cottonseed Meal in Laying and Breeding Rations for Hens

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson, South Carolina.

Period: Three years: November 1, 1927 to October 15, 1928
November 1, 1928 to October 15, 1929
November 1, 1929 to October 15, 1930

Purpose: To determine the value of cottonseed meal as compared with meat scraps as a source of protein for laying hens upon (1) egg production; (2) fertility and hatchability of eggs; and (3) growth and development of chicks produced.

Procedure and Conditions: Each pen consisted of 25 yearling Single Comb White Leghorn hens which were negative to pullorum infection.

All pens were housed in shed-roof open front houses. Lots adjacent to the houses were seeded in a succession of green crops for the birds throughout the year. Two lots were available for each pen. Birds were allowed free range throughout the experiment. Water and oyster shell were available in all pens at all times. Mash was self-fed in hoppers. Grain was fed morning and evening.

Feed and egg records were kept on a pen basis. Averages were figured on a hen day basis for the actual number of hens in each pen. Eggs for hatching were gathered, stored, and incubated under identical conditions. Two cockerels were used in each pen during the breeding season. Males were changed twice each week to eliminate any variation in fertility and hatchability from this factor. All chick and egg weights on all pens were obtained at the same time under similar conditions.

The grain ration for all pens consisted of shelled yellow corn two parts and wheat one part. During the winter months germinated oats were fed at the rate of two pounds daily per 100 hens, at noon. The mash mixtures fed the various pens were as given in the following table.

	Pen 1 Pounds	Pen 2 Pounds	Pen 3 Pounds
Ground yellow corn	200	200	200
Wheat middlings	200	200	200
Meat scraps	100	50	—
Cottonseed meal	—	50	100
Salt	5	5	5
Mineral supplement	—	10	20

The mineral supplement was as follows:

Bone meal	60 parts
Oyster shell meal ($CaCO_3$)	20 parts
Salt (NaCL)	20 parts

In addition to the grain and mash, oyster shell was available in hoppers. Fresh water was always available.

The mash used in pen one (check pen) is the same as that used for the general flock at the college poultry farm.

Results: Egg Production Per Hen and Feed Consumed Per Hen During Test

	First Year	Second Year	Third Year	Av. 3 Years	Av. 3 Years Grain	Av. 3 Years Mash
Pen	Eggs	Eggs	Eggs	Eggs	Lbs.	Lbs.
1	128.7	141.0	152.2	140.6	32.0	33.4
2	134.1	135.6	154.5	141.6	31.9	35.6
3	125.5	132.4	159.0	138.9	31.3	33.9

Reference: South Carolina Agricultural Experiment Station Bulletin 273, "Poultry Feeding Experiments", pages 5, 7, 8, and 9, tables 1, 2 and 3, June 1931, Clemson, South Carolina.

The Effect of Cottonseed Meal and Other Feeds on the Storage Quality of Eggs

Conducted by: Texas Agricultural Experiment Station.

Conducted at: College Station, Texas.

Period: 1930.

Purpose: To determine whether the substance in cottonseed oil causing the trouble with storage quality of eggs was removed by the treatment of oil with sodium hydroxide.

In this study crude cottonseed oil, cottonseed oil which had been treated with sodium hydroxide, and the soap stock resulting from the action of the sodium hydroxide were tested. The soap stock was neutralized with hydrochloric acid before it was fed.

Procedure and Conditions: Single Comb White Leghorns were used in this test.

The hens were fed the same mixture except for the variable feeds being studied. The protein feed including the variable feeds, was fed each hen individually twice daily in gelatin capsules. About two-thirds of this feed was fed in the morning and one-third in the late afternoon.

The hen was fed as follows:

Grams of feed fed each hen daily in addition to the basal ration

	Ration Number								
	1	2	3	4	5	6	7	8	9
Meat and bone scraps	7½	—	—	7½	7½	7½	7½	7½	4
Cottonseed meal	—	12	—	—	—	—	—	—	—
Cottonseed meal with low fat content	—	—	12	—	—	—	—	—	—
Crude cottonseed oil	—	—	—	1	—	—	—	—	—
Partially refined cottonseed oil	—	—	—	—	1	—	—	—	—
Soap stock	—	—	—	—	—	2	—	—	—
Cod liver oil	—	—	—	—	—	—	1	—	—
Linseed oil (raw)	—	—	—	—	—	—	—	1	—
Linseed meal	—	—	—	—	—	—	—	—	4

Rations Fed in Pen Feeding

	Ration Number							
	1	2	3	4	5	6	7	8
Kafir	20	20	20	20	20	20	20	20
Wheat bran	20	10	17	19½	17	17	17	16
Wheat gray shorts	20	20	20	20	20	20	20	20
Ground oats	20	20	20	20	20	20	20	20
Meat and bone scraps	20	—	20	20	20	20	20	12
Cottonseed meal	—	30	—	—	—	—	—	—
Cottonseed oil (crude)	—	—	3	—	—	—	—	—
Soap stock	—	—	—	½	—	—	—	—
Partially refined cottonseed oil	—	—	—	—	3	—	—	—
Cod liver oil	—	—	—	—	—	3	—	—
Raw linseed oil	—	—	—	—	—	—	3	—
Linseed meal	—	—	—	—	—	—	—	12

The eggs from the hens fed the various feeds were stored in the cold storage plant at the Experiment Station.

The eggs were stored in May and June and removed and graded during November. The temperature was between 35 and 43 degrees and the humidity was satisfactory and the loss due to molds was not excessive.

All eggs, except those furnished Dr. Fraps, State Chemist, for analysis, were broken and graded as Firsts, Seconds, and Discards. Those graded as firsts were of normal color and consistency. The yolks of these graded as sec-

Results: Breaking record of eggs from the hens fed in pens

Ration No.	Variable feeds (Percent in ration)	Number of eggs				Per cent		
		Total	Firsts	Seconds	Discards	Firsts	Seconds	Discards
1.	Meat and bone scraps 20, cottonseed meal 0	194	185	3	6	95.4	1.5	3.1
2.	Meat and bone scraps 0, cottonseed meal 30	170	39	15	116	22.9	8.8	68.2
3.	Meat and bone scraps 20, crude cottonseed oil 3	164	30	15	119	18.3	9.1	72.6
4.	Meat and bone scraps 20, soap stock ½	207	197	3	7	95.2	1.4	3.4
5.	Meat and bone scraps 20, partially refined cottonseed oil 3	211	44	32	135	20.9	15.2	64.0
6.	Meat and bone scraps 20, cod liver oil 3	242	240	—	2	99.2	—	.8
7.	Meat and bone scraps 20, raw linseed oil 3	238	234	2	2	98.3	.8	.8
8.	Meat and bone scraps 12, linseed meal 12	290	287	1	2	99.0	.3	.7

onds were slightly off color; they were slightly greenish-yellow or reddish-yellow, but the eggs were still used for cooking purposes. The yolks of the eggs graded as discards varied in color from yellowish-green to green, and in some cases were almost black. Some of the yolks were red in color, while others were almost salmon-colored.

The substance in cottonseed meal that causes the deterioration in quality of eggs in storage is either the oil or something closely associated with the oil which is removed in the final refining, because it is present in both crude cottonseed oil and partially refined cottonseed oil, but is not contained in the soap stock; neither is it found in extracted cottonseed meal having a low fat content, nor in highly refined cottonseed oil (Wesson oil).

Reference: Texas Agricultural Experiment Station Bulletin 429, "Effect of Cottonseed Meal and Other Feeds on the Storage Quality of Eggs", pages 6, 7, 14, 15, 16, and 18, tables 12, 13, and 15, July 1931, College Station, Texas.

VITAMINS: Their use or function, and feeds that supply them.

Vitamin A is essential to the normal growth of chicks. Its absence brings on uneven, stunted growth, and causes adult fowls to have swollen eyes, as in roup. This vitamin is found in green feeds, yellow corn, milk, egg yolk, and cod-liver oil. Plans must be made to include such materials in the ration. Vitamin A supplied in sufficient quantities gives a healthier chick and less susceptible to disease.

An adequate amount of vitamin A should be supplied to breeding hens during the hatching season. Chicks hatched from eggs low in vitamin A content are weak. Such chicks, fed a ration inadequate in vitamin A are never able to overcome the vitamin deficiency in the egg.

Vitamin B is believed to be largely destroyed by heat so that materials containing it are more likely to function when raw than when cooked or heated. It is found in green leaves of plants, milk and its products, whole cereal grains and other seeds, unpolished rice, pasture crops, eggs and yeast. Its absence hampers growth, creates poly-neuritis, prevents normal development of internal organs of secretion, and usually results in the loss of appetite. A ration composed of the usual feeding stuffs will supply adequate vitamin B.

Vitamin C is the anti-scorbutic vitamin and is not considered of great importance in feed for poultry.

Vitamin D is very essential in poultry feeding. Lack of it prevents chicks from forming bones properly so that leg weakness and rickets occur. The deposit of lime and phosphorus in the form of bone fails to take place. This vitamin is furnished in poultry feeding largely through cod-liver oil. Ultra-violet rays, as sunlight not stained through glass, produce the effect of vitamin D. The exposure of birds to direct sunlight is the most practical means of supplying this vitamin.

Vitamin E is present in some animal feeds. It is abundant in green alfalfa, cooked lean meat, and rice. Its presence in rations is necessary for reproduction in animals.

Vitamin G was formerly considered a member of the B group but is believed to be heat-stable and is not destroyed by ordinary cooking. Its absence causes loss of weight, retardation of growth, reduced hatchability and nutritional paralysis.

It is required not only for the growth of chicks but also for growth of chick embryos or hatchability. Instances have been observed where all eggs, produced by hens fed a ration deficient in growth-promoting vitamin G failed to hatch. Less of this factor is required for egg production and maintenance of the health of laying hens than is required for hatchability.

On the average farm the hen is given very little of some vitamins, especially A and G in their feed. However during the spring and summer months vitamin A and some vitamin G is supplied in the grass the hen gets. This being the main source of these vitamins.

Are vitamins essential in a laying hen's ration?

How should the vitamin be supplied?

From an economical standpoint can a person afford to leave some of the vitamins out of the hen's ration?

Vitamin A Activity of Poultry Feeds

The method for estimating vitamin A is not highly accurate. Ordinarily an error of ten per cent may be expected. For this reason the results in the following table are rounded off. In some cases, where the number of units was given by the worker in terms of ounces or pounds, they were calculated by us to units per gram, and then rounded off to 0.1 unit or whole units. If the units per ounce or pounds are then calculated from the units per gram, the results will not check exactly with those given in the table but they will be within the limit of error.

Approximate number of units of vitamin A in feeds

	Units per gram	Units per ounce	Units per pound
Alfalfa meal	12.5	354	5,664
Alfalfa leaf meal	20	567	9,072
Barley, less than	1	28	448
Corn, white	.5	14	224
Corn, yellow	6.6	187	2,992
Corn meal, yellow	5	141	2,256
Cottonseed meal, less than	1.0	28	448
Lettuce	1.5	42	672
Meal, corn, white (estimated)	0	0	0
Oats, less than	0.2	5	80
Peanut meal, less than	0.5	14	224
Wheat (estimated)	0.2	5.6	89
Wheat bran, less than	1	28	448
Wheat gray shorts	0.3	9	144

Reference: Texas Agricultural Experiment Station Bulletin 477, "Vitamin A Content of Food and Feeds", pages 14, 15, 16, 17, and 18, table 3, July 1933, College Station, Texas.

The Vitamin A Requirements of Hens for Egg Production

Conducted by: Texas Agricultural Experiment Station.

Conducted at: College Station, Texas.

Period: December 1, 1933 to August 31, 1934.

Purpose: To determine the Vitamin A requirements of hens for egg production.

Procedure and Conditions: The three groups kept in pens have received the rations given in the following table since November 15, 1932, even though the experiment was not started until December, 1933. There were 18 hens in the pen of the no-alfalfa group, 18 hens in the 4% alfalfa group, and 17 hens in the 8% alfalfa group. On January 26, 1934, six hens from the pen of the no-alfalfa group and five each from the other two groups were placed in individual compartments in hen batteries. All groups in pens received yellow corn as a grain feed, and a mash containing 20% yellow corn. One group received no alfalfa meal. The second group received 4% of heat-dried alfalfa leaf meal in place of 4% of wheat bran in the mash and the third group received 8% of heat-dried alfalfa leaf meal in place of the 8% of wheat bran. These groups will be referred to as the no-alfalfa group, the 4% alfalfa group, and the 8% alfalfa group.

Ingredients of Mixtures Used for Laying Fowls in Pens

Ingredients of Feed	No-alfalfa group	4% alfalfa group	8% alfalfa group
MASH	**Per cent**	**Per cent**	**Per cent**
Ground yellow corn	20	20	20
Wheat gray shorts	29	29	29
Wheat bran	29	25	21
50% protein meat and bone scrap	20	20	20
Alfalfa leaf meal	0	4	8
Chick size oyster shell	1	1	1
Salt	1	1	1
GRAIN			
Yellow corn ad lib			

The average amount of vitamin A fed to the hens in the different pens during the period of 274 days was 134 units per day for the no-alfalfa group, 209 units per day for the 4% alfalfa group, and 351 units per day for the 8% alfalfa group.

Results: Relation of Percentages of Eggs Which Hatched to Vitamin A in Feed of Hens

Date Hatched	No. of Eggs	No-alfalfa group, 134 units vitamin A fed per day	No. of Eggs	4% alfalfa group, 209 units vitamin A fed per day	No. of Eggs	8% alfalfa group, 351 units vitamin A fed per day
		% hatched		% hatched		% hatched
March 2, 1934	48	41.67	49	75.51	52	78.85
April 2, 1934	51	33.33	101	70.30	51	68.63
April 15, 1934	53	33.95	51	68.63	101	69.31
April 25, 1934	51	35.30	—	——	—	——
Total or Average	203	35.96	201	71.14	204	71.57

According to experimental work done at Texas Experiment Station, it is estimated that it requires 4 units of vitamin A potency in the feed to produce one unit in the egg with a yolk weighing 15 grams and containing 20 units vitamin A to the gram of yolk would require 1200 units of Vitamin A. Hens laying 150 eggs in 10 months, or 15 eggs a month would require 600 units per day. This is appreciably more than the 444 units used in any of our experiments. During the molting season, equally as much would be required, if we judge from the work reported in this Bulletin. If the fowls eat 80 grams of mash and grain they should require 7.5 units of vitamin A per gram of feed to supply the 600 units of vitamin A needed.

This high quantity of vitamin A can be supplied best by supplementing the feed with fresh green growing plants such as alfalfa, clover, mustard, spinach, turnip greens, oats, wheat, or grasses. Sprouted oats, cabbage, let-

Pounds of Grain, Mash and Units of Vitamin A Eaten Per Month Per Hen, Number of Deaths, Average Weight of Hens, and Number Eggs Per Hen

	NO ALFALFA GROUP						4% ALFALFA GROUP						8% ALFALFA GROUP					
	Lbs. Feed		Units Vit. A	No. Deaths	Ave. Wt. of Hen	Eggs Per Hen	Lbs. Feed		Units Vit. A	No. Deaths	Ave. Wt. of Hen	Eggs Per Hen	Lbs. Feed		Units Vit. A	No. Deaths	Ave. Wt. of Hen	Eggs Per Hen
	Grain	Mash					Grain	Mash					Grain	Mash				
Dec.	2.78	3.06	5539	0	3.56	7.4	3.86	2.28	8862	0	3.68	7.8	2.97	4.27	12512	0	3.49	9.2
Jan.	3.03	3.00	5602	2	3.43	13.8	3.02	2.35	8732	0	3.36	11.8	3.15	2.59	13003	0	3.17	15.4
Feb.	3.34	4.36	6115	0	3.43	12.9	2.34	3.00	7453	0	3.37	10.3	2.43	2.93	12154	1	3.19	12.5
Mar.	3.07	3.65	5176	0	3.52	15.5	2.61	3.15	8304	0	3.30	12.6	3.18	3.00	12558	0	3.11	16.0
April	2.06	3.18	3432	0	3.59	10.5	1.72	2.28	5167	0	3.28	8.9	2.18	2.50	9216	1	3.15	12.7
May	2.16	2.65	3173	1	3.48	11.0	1.58	2.83	5621	1	3.18	10.2	2.04	3.21	11908	1	3.07	13.1
June	1.72	2.33	2388	0	3.29	6.0	1.30	2.69	4744	1	3.19	6.6	1.74	3.06	8785	0	2.98	16.1
July	2.05	1.79	2515	2	3.17	1.5	1.53	2.38	4290	0	3.14	3.7	1.82	3.22	8767	0	3.01	9.1
August	2.43	1.79	2788	1	3.40	5.4	1.69	2.19	4118	0	3.13	3.3	2.13	2.59	7350	1	3.14	6.4
Total	22.65	25.83	36728	6	3.43	84.1	18.66	23.17	57389	2	3.29	75.2	21.65	27.39	95253	4	3.15	109.5
Av. per day			134						209						351			

tuce, or similar light colored green feeds are not sufficiently rich in vitamin A for the purpose.

The four units in the feed required for one unit in the egg were apparently sufficient both for the eggs and for maintenance.

It is estimated that if the vitamin A content of the eggs is disregarded, laying hens may be kept in good health and produce eggs in good quantities on approximately 240 units of vitamin A per day, or 3 units per gram of total feed. This estimate is tentative but should serve a useful purpose until more accurate estimates can be made. Hens which have access to green feed from time to time may do well on feed containing less vitamin A than here estimated.

Reference: Texas Agricultural Experiment Station Bulletin 514, "Vitamin A Requirements of Hens for Egg Production", pages 5, 6, 9, 10, 19 and 21, tables 1, 6, 7, 8, 9, 11 and 12, September 1935, College Station, Texas.

The Quantities of Vitamin A Required for Vitamin A in the Eggs

Conducted by: Texas Agricultural Experiment Station.

Conducted at: College Station, Texas.

Period: October 15, 1931 to April 30, 1932.

Purpose: To ascertain the effect of the quantity of vitamin A fed to pullets upon the quantity of vitamin A in the eggs.

Procedure and Conditions: White Leghorn pullets that had been raised upon a standard ration, including free access to green feed, were divided into three groups of 36 pullets each, each group being subdivided into two lots of 18 pullets each. One pullet of poor quality was removed from each group on November 5, leaving 35 pullets on each ration. One cockerel was placed with each lot of pullets. The cockerels were exchanged between the lots each week. The feeding began the morning of October 15, 1931, and ended the night of April 30, 1932. The chickens were kept in pens having cement floors, without access to green feed. The pullets had an abundance of sunshine so that the equivalent of vitamin D was well supplied. Yellow corn and white corn were used in varying the amounts of vitamin A in the rations, as fresh yellow corn is comparatively high in this vitamin, while white corn contains practically no vitamin A.

The ingredients of mixtures used for the laying pullets is as follows:

Mash	Group 1	Group 2	Group 3
Yellow corn meal	20	10	
White corn meal		10	20
Wheat gray shorts	20	20	20
Wheat bran	20	20	20
Ground whole oats	20	20	20
50% protein, meat and bone scraps	20	20	20
Scratch			
Yellow corn	100	50	
White corn		50	100

Results: **The Weight of Feed, Eggs Laid, and Vitamin A in Feed, Eggs by Months and Eggs per Pullet**

	Oct. 15-31	Nov.	Dec.	Jan.	Feb.	Mar.	April	Total
Feed eaten—Yellow corn group								
Yellow corn per pullet, lbs.	1.631	3.070	3.117	3.036	2.809	3.094	2.909	
Mash per pullet, lbs.	1.447	2.233	2.913	2.958	3.362	3.436	2.221	
Grain per pullet, lbs.	1.342	2.623	2.534	2.444	2.137	2.407	2.265	
Yellow corn per egg, pounds	.815	.364	.328	.257	.213	.170	.166	
Feed eaten—Mixed corn group								
Grain per pullet, lbs.	.868	2.637	2.432	2.375	1.966	2.157	1.853	
Mash per pullet, lbs.	1.447	2.247	2.635	2.036	2.165	3.671	2.656	
Yellow corn per pullet, pounds	.579	1.543	1.480	1.391	1.200	1.446	1.192	
Yellow corn per egg, pounds	.443	.190	.207	.158	.089	.092	.089	
Feed eaten—White corn group								
Grain per pullet, pounds	.750	2.586	2.581	2.457	3.203	3.108	2.253	
Mash per pullet, pounds	1.487	2.042	2.237	2.441	1.861	1.688	1.481	
Weight of yolk in grams								
Yellow corn group	14.5	14.4	15.7	15.9	16.0	16.0	16.2	
Mixed corn group	14.7	14.7	15.7	16.5	16.0	15.8	15.5	
White corn group	15.0	14.9	15.4	17.4	15.8	16.0	16.0	
Units of vitamin A per pound of yellow corn	3,175*	3,000	2,800	2,720*	2,600	2,500	2,400	
Units of vitamin A per egg								
Yellow corn group	290	288	267	223	160	128	81	
Mixed corn group	294	176	188	165	128	95	124	
White corn group	300	194	185	174	221	80	64	
Units vitamin A eaten per egg								
Yellow corn group	2,702	1,092	918	699	554	425	389	
Mixed corn group	1,407	570	580	430	231	230	214	
Units vitamin A eaten per pullet								
Yellow corn group	5,178	9,210	8,728	8,258	7,303	7,735	6,982	53,394
Mixed corn group	1,838	4,629	4,144	3,784	3,120	3,615	2,861	23,991
Vitamin A in eggs in percentage of that fed								
Yellow corn group	10.8	26.4	29.1	31.9	28.9	30.0	20.4	26.3
Mixed corn group	21.0	30.8	32.4	38.4	53.8	39.9	56.4	38.9
Eggs per pullet								
Yellow corn group	1.92	8.45	9.51	11.82	13.17	18.15	17.56	80.58
Mixed corn group	1.31	8.10	7.14	8.81	13.12	15.18	13.02	66.68
White corn group	3.64	9.67	5.32	7.95	9.24	12.91	6.76	55.49

*Direct estimation, others assumed from the estimations made.

Reference: Texas Agricultural Experiment Station Bulletin 468, "The Amount of Vitamin A Required by Pullets for Maintenance and for Egg Production", pages 5, 6, 11, and 13, tables 9 and 10, December 1932, College Station, Texas.

The Effect of Varying the Vitamin A Content of Feed for Hens

Conducted by: Texas Agricultural Experiment Station.

Conducted at: College Station, Texas.

Period: 290 days, November 15, 1932 through August 31, 1933.

Purpose: To determine the effect of varying the Vitamin A content of the feed for laying hens.

Procedure and Conditions: White Leghorn fowls that had been raised upon the standard ration of the Texas Agricultural Experiment Station, including free access to green feed, were divided into three groups each containing 18 pullets and 18 hens. Two cockerels were rotated from group to group for a sufficient time to secure eggs suitable for hatching.

The three lots received yellow corn as a grain feed and a mash containing 20% of yellow corn. One group received no alfalfa meal. For a second group, 4% of wheat bran was replaced in the mash given the first group by 4% of heat-dried alfalfa leaf meal and for a third group a corresponding replacement was made with 8% of the alfalfa leaf meal. These groups will be referred to as the no-alfalfa group, the 4% alfalfa group, and the 8% alfalfa group. The complete rations used are given in the following table.

Ingredients of Mixtures Used for Laying Fowls

Ingredients of Feed	No-alfalfa group	4% alfalfa group	8% alfalfa group
Mash	**Per cent**		
Yellow corn meal	20	20	20
Wheat gray shorts	20	20	20
Wheat bran	20	16	12
50% protein meat and bone scrap	20	20	20
Alfalfa leaf meal	0	4	8
Ground whole oats	20	20	20
Grain			
Yellow corn ad lib			

The average amount of vitamin A fed during the period of 290 days was 224 units per day per fowl for the no-alfalfa group, 336 units for the 4% alfalfa group and 444 units for the 8% alfalfa group.

The heat-dried alfalfa leaf meal was excellent in quality, containing about 80 units of vitamin A potency per gram when fresh. It was much richer in this respect than ordinary alfalfa leaf meal. The yellow corn was of good quality, as it contained about 7 units of vitamin A per gram at the beginning of the experiment. The determination of vitamin A in the mash containing 20% yellow corn, and no alfalfa meal, showed that the yellow corn accounted for all of the vitamin A in this mash, showing that the other ingredients of this mash contained practically no vitamin A.

Correction was made for the food eaten by the cockerels on the assumption that they ate the same as hens.

The fowls were kept in pens having cement floors to prevent access to green feed. They had an abundance of sunshine so that the equivalent of Vitamin D was well supplied.

Results: The Effect of Varying the Vitamin A Content of Feed for Hens

Month	Average weight of fowls in Lbs.*			Average number of eggs per fowl**		
	No-alfalfa group	4% alfalfa group	8% alfalfa group	No-alfalfa group	4% alfalfa group	8% alfalfa group
November	2.97	3.07	3.00	1.34	2.06	1.70
December	3.06	3.20	3.16	5.62	5.59	4.81
January	3.39	3.56	3.44	12.14	10.31	12.88
February	3.41	3.59	3.52	14.75	14.20	14.67
March	3.24	3.38	3.45	18.70	18.94	19.37
April	3.12	3.28	3.28	17.13	18.31	19.10
May	2.87	2.98	3.08	14.15	14.56	17.96
June	2.89	2.98	3.11	11.37	10.41	14.33
July	2.88	2.87	2.99	9.43	8.44	12.40
August	2.71	2.87	2.94	.40	4.87	7.37
Av. or total	3.05	3.18	3.20	109.03	107.69	124.69

*Av. weight of fowls in lbs. is of the 16th of each month.

**Number eggs per calendar month.

During the test 11 chickens died in the no-alfalfa group, in the 4% alfalfa group there were 5 deaths and 6 deaths in the 8% alfalfa group.

Reference: Texas Agricultural Experiment Station Bulletin 493, "The Amount of Vitamin A Potency Required by Hens for Egg Production", pages 6, 8, 9, 10, and 11, tables 1, 4, 5, and 6, August 1934, College Station, Texas.

Effect of Vitamin D Supplement on Laying Hens

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: 1927-1929.

Purpose: To test the effectiveness of sunshine, cod liver oil and ultraviolet light for egg production.

Procedure and Conditions: All pens except pen 6, received an all mash ration consisting of:

650 pounds	ground yellow corn
100 pounds	wheat bran
100 pounds	wheat middlings
75 pounds	meat scrap
25 pounds	dried buttermilk
20 pounds	ground limestone
20 pounds	bone meal
10 pounds	salt

Pen 6 received the same mixture except that 500 pounds of the corn was fed as grain in the litter. This pen was included in order to make the conclusions and findings available for the poultrymen who use a grain and mash ration by comparison of pen 6 with the other lots. Since this experiment was started it has been found that an all-mash ration was as effective as a grain and mash ration for the production of eggs under Kentucky conditions.

The treatment of the various pens in this experiment was as follows:

Pen 1—No supplement, confined to house and glass porch. All sunlight through ordinary glass.
Pen 2—Irradiation with a quartz mercury vapor arc lamp 30 minutes daily at a distance of five feet. Confined to the house and glass porch.
Pen 3—Two percent of cod liver oil. Confined to the house and glass porch.
Pen 4—Confined to the house and wire-screened porch or "sun-parlor" thus receiving unfilter sunlight.
Pen 5—Bluegrass range.
Pen 6—Bluegrass range.

Water and oyster shell flour were available at all times in all pens.

During the season of 1927-28, fifteen Barred Plymouth Rock and fifteen White Leghorn pullets were used in each pen, but in 1928-29 each pen contained nineteen White Leghorn and twelve Barred Plymouth Rock yearling hens, which had been trap-nested during their pullet year. Maturity, weight, vigor and egg records were considered in distributing these hens among the pens.

Results:

Pen No.	Source of Vitamin D	White Leghorns						Barred Plymouth Rocks					
		1927-1928			1928-1929			1927-1928			1928-1929		
		Winter	Experimental Period	Post Experimental Period	Winter	Experimental Period	Post Experimental Period	Winter	Experimental Period	Post Experimental Period	Winter	Experimental Period	Post Experimental Period
1	No supplement	36.2	72.7	48.6	12.0	37.2	52.5	27.1	53.6	38.8	8.7	39.3	32.5
2	Irradiation	38.5	80.9	49.7	20.4	66.3	47.1	34.8	81.6	43.6	9.7	50.3	30.8
3	Cod liver oil, 2 oz.	30.4	71.3	40.5	17.3	65.4	47.8	29.4	70.5	40.5	11.6	49.1	40.2
4	Sunshine (porch)	31.5	68.9	45.1	16.5	67.4	46.8	36.4	77.4	44.6	10.7	42.0	34.2
5	Range (all mash)	44.2	102.3	42.1	23.4	77.1	40.5	29.9	92.4	37.9	13.0	61.7	29.9
6	Range (grain and mash)	34.8	96.3	51.3	21.6	81.5	48.0	35.6	90.1	40.9	18.4	71.1	38.8

Note: Winter period, November 1 to March 1.
Experimental period, November 1 to June 1.
Post experimental period, June 1 to September 1.

Reference: Kentucky Agricultural Experiment Bulletin 304, "Effect of Vitamin D Supplements on Laying Hens", pages 191 and 192, tables 1 and 2, April 1930, Lexington, Kentucky.

Cod Liver Oil for Laying Pullets

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: September 1, 1929-June 30, 1930.
October 1, 1930-September 30, 1931.
October 1, 1931-September 30, 1932.

Purpose: To test the effect of cod liver oil on egg production, size of egg and fertility and hatchability, when it was included in the ration of White Leghorn pullets confined to the house, allowed sunshine and allowed bluegrass range.

Procedure and Conditions:

1929-30: Thirty White Leghorn pullets were put into each pen.
1930-31: Twenty-five White Leghorn pullets were used.
1931-32: Twenty-five White Leghorn pullets were again put into each pen.

The pullets were selected to make the pens as nearly as possible equal in maturity, weight, vigor and ancestry. The pens were housed September 1, 1929; October 1, 1930; and October 1, 1931. The houses were identical in construction and orientation.

All pens received the following all-mash mixture fed dry in hoppers:

Ground yellow corn	650 pounds
Wheat bran	100 pounds
Wheat middlings	100 pounds
Meat scrap (50% protein)	75 pounds
Dried buttermilk	25 pounds
Finely ground limestone	20 pounds
Steamed bone meal	20 pounds
Salt	10 pounds

Coarsely ground limestone (approximately 99% $CaC0_3$) and water were also available to all pens at all times.

The pens were treated as follows:

First pair. Confined to house, sunlight filtered through common window glass
Pen 1. No cod liver oil
Pen 2. Cod liver oil, 2 per cent of the mash

Second pair. Confined to house and wire-screened, wirefloored sun porch
Pen 3. No cod liver oil
Pen 4. Cod liver oil, 2 per cent of the mash

Third pair. Allowed range of bluegrass yard
Pen 5. No cod liver oil
Pen 6. Cod liver oil, 2 percent of the mash

In 1929-30 and 1930-31, one cockerel was added to each pen at the beginning of the hatching season. Substitutions were made, if the males showed lack of vigor or if fertility was low. In 1931-32, cockerels were placed in each pen five days before eggs for incubation were to be saved, and remained during the time that eggs were saved for this purpose. They were then removed and placed in a holding pen with access to bluegrass range. The males were rotated among the pens.

Results: Cod Liver Oil for Laying Pullets

Pen No.	Treatment	1929-1930 Winter	1929-1930 10 Mos.	1930-1931 Winter	1930-1931 Year	1931-1932 Winter	1931-1932 Year
1.	Confined. No supplement	30.4	68.6	47.1	112.0	30.9	70.9
2.	Confined. 2% cod liver oil	47.0	115.1	55.3	156.2	46.3	149.2
3.	Sunshine. No supplement	43.6	113.1	59.0	172.2	33.3	132.2
4.	Sunshine. 2% cod liver oil	51.6	125.5	65.8	190.2	47.4	149.1
5.	Bluegrass range. No supplement	31.7	114.9	68.4	202.3	55.0	171.8
6.	Bluegrass range. 2% cod liver oil	45.2	127.6	68.3	202.5	61.2	158.3

Reference: Kentucky Agricultural Experiment Station Bulletin 337, "Cod Liver Oil for Laying Pullets", pages 5, 6, and 7, table 1, February 1933, Lexington, Kentucky.

The Effect of Vitamin G on Egg Production, Maintenance, and Hatchability of Egg with Laying Hens

Conducted by: Cornell University Agricultural Experiment Station.

Conducted at: Ithaca, New York.

Period: Forty weeks.

Purpose: To determine the vitamin G requirements of poultry.

Procedure and Conditions: The protein content of this diet was held to 16 per cent, air-dry basis, whenever a new batch of feed was mixed, by making adjustments in the quantity of ground corn and purified casein. New batches of the diet were prepared from fresh ingredients every eight weeks.

The basal diet was as follows:

	Per Cent
Ground yellow corn	47.9
Wheat-flour middlings	20.0
Wheat bran	20.0
Purified casein	5.6
Oyster-shell flour	3.5
Steamed bonemeal	1.5
Salt, iodized	0.5
Cod-liver oil	1.0

White Leghorn pullets of the Cornell strain were used in this experiment. Each lot contained 29 individuals at the start. The pullets were trap-nested and individual egg records were kept. The condition of the pullets throughout the experiment was ascertained by general observations and by individual weighings at intervals of four weeks.

Results: Effect of Vitamin G on Egg Production and Maintenance of Laying Pullets

	Lot 1 Control	Lot 2 2.5% dried skimmilk	Lot 3 2.5% dried whey	Lot 4 5% dried skimmilk	Lot 5 5% dried whey
Per cent egg production	57.0	59.8	50.9	51.6	58.1
Average number of eggs per hen	159.7	167.3	142.5	144.3	162.7
Average egg weight in grams	51.8	51.7	51.7	51.2	52.5
Average feed consumed per hen, in grams	28174	29069	28350	26192	28640
Average initial body weight of hens in grams	1767	1747	1804	1721	1765
Average final body weight of hens in grams	1697	1671	1785	1657	1810
Average body weight for ten periods in grams	1733	1749	1788	1721	1852
Percent mortality	55	41	45	55	38

Summary of Hatchability Results

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Control	2.5% dried skimmilk	2.5% dried whey	5% dried skimmilk	5% dried whey
Total number of eggs set	225	383	241	270	404
Average per cent fertility	85.3	86.7	88.4	80.7	81.4
Average per cent of dead embryos on seventh day*	11.5	5.7	4.7	2.8	4.0
Average per cent of dead embryos on eighteenth day*	50.0	38.9	21.6	5.5	9.1
Average per cent hatchability**	21.9	38.9	48.8	69.7	70.5

*Expressed as percentage of fertile eggs.

**Percentage of fertile eggs set which produced good chicks.

Reference: Cornell University Agricultural Experiment Station Bulletin 660, "The Vitamin G Requirement of Poultry", page 8, tables 6 and 7, September 1936, Ithaca, New York.

MINERAL SUPPLEMENTS—Are minerals necessary in a laying hen's ration? What are minerals?

Minerals are sometimes referred to as ash including those mineral compounds which are a part of bones and tissues, eggs, shells, and feedstuffs. Essential for normal, strong tissues and bony framework, and for egg production. Calcium is probably the most important mineral required; for it forms, as a carbonate, nearly the entire egg shell, and, in combination with phosphorus and magnesium, an important part of the bone. Other minerals probably required in poultry rations are potassium, silicon, sulphur, chlorine, sodium, iodine, iron and managanese.

How are minerals used by the hen?

Minerals are used for body maintenance. As has already been stated the hen's body is made up of approximately 4% minerals. Minerals are essential for proper bone development.

In addition to body maintenance the laying hen must have mineral for egg development. The egg shell is practically all mineral. Twelve per cent of the whole egg is mineral.

Minerals also appear to assist in the more complete digestion of proteins and other nutrients. It has been found that mineral contents of grain feeds is not enough to meet the needs of the laying hen. Therefore, the required amount of mineral must be supplied from other sources.

Meat protein sources contain considerably more minerals than the grain sources of protein. This fact should be considered in feeding the laying hen.

Sodium, chlorine, phosphorous, and calcium are the minerals most commonly deficient in the laying hen's ration. The sodium and chlorine may be supplied very easily by the addition of a small amount of salt in the ration. Calcium may be supplied by using oyster shell or limestone. This mineral is one of the most important and should be supplied in sufficient quantities at all times.

In going to farm homes in Mississippi and the poultry house and yard are visited is it common to find oyster shell available to the chickens?

No doubt the practice of supplying minerals to laying hens is one of the most important feeding practices.

What effect does minerals have on the hen, and egg production?

What source of mineral should be used in feeding laying hens?

The Effect of Various Proteins With Mineral Supplements on Egg Production

Conducted by: Missouri Agricultural Experiment Station.

Conducted at: Columbia, Missouri.

Period: November 1, 1926 to September 30, 1927.

Purpose: To determine the effect of various proteins with mineral supplements on egg production.

Procedure and Conditions: Seven pens of hens were used in order to show the effect of various proteins with mineral supplements on egg production. These proteins and mineral supplements were included in a mash mixture, which was made up of equal parts of bran, yellow cornmeal, and shorts. Where used, the cottonseed meal made up 30 per cent of the mash mixture; the ground soybeans, 30 per cent; the soybean meal, 30 per cent; tankage, 20 per cent; meat scraps, 20 per cent; dried buttermilk, 30 per cent; rock phosphate, 8 per cent; and bone meal, 4 per cent. All the mashes contained 1 per cent of salt.

The grain fed was made up of two parts by weight of yellow corn to one part of oats.

Results: The Effects of Different Protein Concentrates on Feed Consumption in Pounds and Egg Production Per Hen

	Cottonseed meal & rock phosphate	Cottonseed meal & bone meal	Ground soybeans & bone meal	Soybean meal & bone meal	Tankage	Meat scraps	Dried butter milk
	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5	Pen 6	Pen 7
Mash:							
Cottonseed meal 30 per cent	7.50	7.50					
Rock phosphate 8 per cent	2.00						
Bone meal 4 per cent		1.00	.96	.96			
Soybean meal 20 per cent				7.20			
Meat scraps						5.60	
Dried buttermilk							8.70
Tankage					5.40		
Ground soybeans			7.20				
Salt	.26	.24	.24	.24	.27	.29	.29
Bran	5.08	5.42	5.20	5.20	7.11	7.37	6.67
Yellow corn meal	5.08	5.42	5.20	5.20	7.11	7.37	6.67
Shorts	5.08	5.42	5.20	5.20	7.11	7.37	6.67
Total mash per hen	25.00	25.00	24.00	24.00	27.00	28.00	29.00
Grain:							
Corn	24.00	32.00	34.67	36.67	36.67	42.67	36.00
Oats	17.00	16.00	17.33	18.33	18.33	21.33	18.00
Total grain consumed Per Hen	51.00	48.00	52.00	55.00	55.00	64.00	54.00
Av. Egg Production Per Hen	125	130	113	132	125	139	140

Reference: Agricultural Education Vol. 7, No. 1, page 21, table 6, September 1930, Clemson, South Carolina.

A Comparison of Mineral Supplements in the Laying Hens Diet

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: December 1, 1920 to July 31, 1921.

Purpose: To determine whether mineral supplements are necessary for laying hens.

Procedure and Conditions: Six lots, containing ten seven-months-old white Leghorn pullets, were fed a uniform diet of dry mash and grain supplemented by mineral substances. They were confined to the house with a concrete floor and at no time allowed access to the ground. No milk or green feeds were fed.

The dry mash was made up as follows:

Corn meal	6 parts
Bran	3 parts
Middlings	3 parts
Ground oats	3 parts
Tankage	5 parts
Charcoal	1 part

The grain mixture consisted of 2 parts corn and one part oats. The mash was before the hens all the time. The grain was fed in the straw on the floor twice a day. The mineral substances were available to the designated pens.

Results: **Average Egg Production, Mortality, and Gain for Hens Fed Different Mineral Supplements**

	Minerals Fed					
	None	Grit	Grit and oyster shell	Grit and limestone	Limestone	Rock phosphate
Eggs per hen	34.5	39.7	53.2	56.6	61.8	21.6
Number of deaths	8.0	4.0	6.0	3.0	6.0	5.0
Gain in weight of the survivors (per cent)	19.0	26.0	—3.0	9.0	20.0	21.0

Kentucky Bul. 250

Reference: Agricultural Education Vol. 7, No. 1, page 27, table 12, Clemson, South Carolina.

A Comparison of Animal and Vegetable Proteins With and Without Minerals

Conducted by: Indiana Agricultural Experiment Station.

Conducted at: LaFayette, Indiana.

Period: October, 1920 to September 30, 1924.

Procedure and Conditions: The birds used were two pens of Single Comb White Leghorn pullets and six pens of Barred Plymouth Rock pullets with 30 to the pen.

The basal grain mixture for all pens was ten parts each of corn and wheat and five parts oats, with a mash mixture of five pounds of bran and five pounds of flour middlings. Grit and oyster shells were always available in hoppers. The birds were allowed free range over a grassy lot containing fruit trees except during the severe winter weather.

The percentage of the principal minerals of the ash content of tankage and soybean oil meal are as follows:

Minerals	Soybean oil meal	Tankage
Chlorine	.02	2.00
Phosphorus	1.43	6.66
Sodium	.05	2.06
Calcium	.38	8.26
Carbon dioxide	.35	.51

The mineral mixtures were made up as follows: Twenty-four pounds limestone and fifteen pounds salt with either twenty-one pounds soluble bone, twenty-two pounds steam bone or forty-two pounds acid phosphate when fed with soybean oil meal. In using a vegetable protein such as soybean oil meal, 8 to 10 per cent was the amount of mineral mixture added to the mash.

Results: Average Feed Consumption in Pounds and Egg Production per Hen When Fed Animal and Vegetable Proteins With and Without Minerals

	Barred Rocks				White Leghorns			
	Feed Consumption	Eggs per hen	Per cent Fertility	Per cent Hatchability	Feed Consumption	Eggs per hen	Per cent Fertility	Per cent Hatchability
Tankage alone:								
1920-21	81.1	143.5	83.6	36.7	63.4	117.4	95.9	81.6
1921-22	81.7	138.5	85.0	56.8	70.4	139.8	91.8	37.3
1922-23	77.9	131.9	98.1	62.3	63.2	132.6	83.7	61.1
1923-24	76.7	153.2	91.6	60.6	74.8	186.3	77.1	54.1
Soybean oil meal alone								
1920-21	62.7	38.6	70.9	54.8				
1921-22	63.5	38.7	80.3	44.4				
1922-23	53.2	27.2	77.2	38.2				
Soybean oil meal and:								
1920-21: Steam bone meal	65.0	40.3	100.0	77.7	54.6	57.1	91.9	78.1
1921-22: Limestone, salt and soluble bone	84.7	124.9	66.1	32.8	80.1	150.8	77.4	63.7
1922-23: Limestone, salt and acid phosphate	76.5	137.5	75.4	43.6	63.9	144.2	86.8	77.1
1923-24: Limestone, salt and steam bone	73.4	135.2	83.2	79.3	69.6	172.7	84.1	72.3
½ Tankage; ½ soybean oil meal and:								
1920-21: Steam bone meal	81.1	135.2	85.3	68.5				
1921-22: Limestone, salt and soluble bone	82.3	123.1	85.0	45.7				
1922-23: Limestone, salt and acid phosphate	79.0	144.8	58.1	53.1				
1923-24: Limestone, salt and steam bone	78.2	141.8	90.4	68.7				

Note: Minerals, when added, constituted 10 per cent of the mash. Ind. Bul. 293

Reference: Agricultural Education Vol. 7, No. 1, pages 22, 23 and 24, table 7, September 1930, Clemson, South Carolina.

Limestone Grit Versus Oyster Shell for Hens

Conducted by: Maryland Agricultural Experiment Station.

Conducted at: College Park, Maryland.

Period: November 1, 1921—September 26, 1922.

Procedure and Conditions: Two pens of Leghorns were fed limestone and two similar pens were given crushed oyster shell. A blue limestone high in calcium content, quarried at Morgantown, West Virginia, and ordinarily commercial crushed oyster shell were compared.

All pens were fed a mash composed of wheat bran 200 pounds; wheat middlings 100 pounds; corn meal 100 pounds; meat scrap 100 pounds, and salt 2½ pounds.

Pens 1 and 2 received a grain mixture of whole corn and wheat.

Pens 3 and 4 received cracked corn and wheat, both parts by measure. All four pens had access to yards.

Results: Limestone Grit Versus Crushed Oyster Shell

Pen No.	Average No. Birds	Average Per Bird				
		Mash	Grain	Shell	Grit	Eggs
1	37.69	34.29	34.30	2.91	——	143.17
2	37.70	32.38	32.38	——	2.21	134.85
3	38.37	30.04	30.10	2.47	——	130.28
4	39.53	31.17	31.40	——	2.25	131.44

Hatching Record, Limestone Fed Hens Vs. Crushed Oyster Shell

	Eggs Set	Sterile	Dead			Pipped	Hatched	Per cent Hatched
			7th Day	14th Day	21st Day			
Limestone fed	388	44	15	11	39	24	255	66
Oyster shell fed	387	46	25	13	36	22	243	62.8

Reference: Maryland Agricultural Experiment Bulletin 377, "Miscellaneous Studies on Poultry Grit", pages 318 and 319, tables 1 and 2, June 1935, College Park, Maryland.

MASH, GRAIN, ETC. IN RATIONS FOR LAYING HENS

As stated in the general discussion the hen on the average farm is given whole corn plus what feed may be picked up. Very few flocks are given a varied grain feed or grain and mash. This condition is possibly due to not having many other feeds available on the farm, and the feeds available are used rather than purchasing additional feed.

Will corn alone give the needed feed elements?

Are laying hens profitable on the average Mississippi farm?

Will an all grain ration supply sufficient feed elements?

What is a satisfactory grain mixture for laying hens?

Is mash necessary for laying hens?

What Are Satisfactory Grain Mixtures for Laying Hens?

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: November 1, 1922 to October 31, 1924.

Purpose: To compare the value of various grain mixtures for laying hens when supplemented with skimmilk.

Procedure and Conditions: The birds used were Barred Plymouth Rocks, with 20 to the pen. Grit and Oyster shell were available for all pens at all times. No water was given the birds but skimmilk was kept before them all the time.

The following table shows the rations for the various pens.

Feeds Used

	Pen* 14	Pen* 15	Pen* 16	Pen* 17
	Per cent			
Corn	**	70	70	60
Oats		30	—	20
Wheat		—	30	20

*All pens received sour skimmilk. Ky. Bul. 260

**Shelled corn was the only grain fed.

Results: Average Annual Feed Consumption and Egg Production Per Hen, Two-Year Average

	Pen 14	Pen 15	Pen 16	Pen 17
Feed consumption per hen				
Grain, lbs.	71	75	70	68
Mash, lbs.	—	—	—	—
Milk, gal.	14	16	14	15
Eggs per hen: Winter	50	56	66	61
Year	165	166	177	175

Reference: Agricultural Education Vol. 9, No. 8, April 1933, page 120, tables 10 and 11, Clemson, South Carolina.

Whole Oats in Ration of Laying Hens

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson, South Carolina.

Period: Beginning November 24, 1937 and running for a period of 224 days.

Purpose: To study the use and value of whole oats when supplied to laying hens free-choice.

Procedure and Conditions: Four pens of birds each containing 30 single Comb White Leghorn pullets were used in the test. Each group was housed in a pen 10 feet by 20 feet, with an adjacent cinder run for exercise and exposure to sunlight. Mash, grain (all components), oyster shell, and grit were fed free-choice. In order to eliminate the element of habit in the consumption of the various grains fed, the location of the hoppers containing the grains was changed every four weeks.

The mash used in the various pens was made up as follows:

	Pens 1 and 2	Pens 3 and 4
Ground yellow corn	46.5 parts	27.5 parts
Ground oats	——	20.0
Wheat middlings	20.0	20.0
Meat scraps	10.0	9.0
Fish meal	8.0	8.0
Dried milk	7.0	7.0
Alfalfa leaf meal	7.0	7.0
Salt	1.0	1.0
Cod-liver concentrate	0.5	0.5

The grains supplied to the various pens were as follows:

Pen 1—Shelled yellow corn and wheat
Pen 2—Shelled yellow corn, wheat and whole oats
Pen 3—Shelled corn and wheat
Pen 4—Shelled yellow corn, wheat and whole oats

Results: The Use of Whole Oats in the Laying Ration

	Pen Number			
	1	2	3	4
Average number of eggs per bird	141.7	144.2	136.9	143.5
Mash consumed per bird—pounds	18.6	19.3	18.4	17.7
Grain consumed per bird—pounds	34.3	43.4	35.5	43.6
Mash consumed—% of total ration	35.2	30.8	34.2	28.9
Corn consumed—% of total ration	9.0	5.3	9.4	5.8
Wheat consumed—% of total ration	55.8	33.4	56.5	28.5
Whole oats—% of total ration	—	30.5	—	36.8
Initial body weight per bird—pounds	3.7	4.1	4.0	4.1
Final body weight per bird—pounds	3.7	4.3	3.8	3.8
Total mortality—%	21.4	29.0	20.0	31.0

Reference: South Carolina Agricultural Experiment Station Fifty-first Annual Report, pages 83 and 84, table 20, December 1938, Clemson, South Carolina.

Is Mash Necessary for Laying Hens?

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: November 1, 1920 to October 31, 1923.

Purpose: To compare sour skim milk, condensed buttermilk and meat scrap when used with mash and grain and also to compare sour skimmilk and condensed buttermilk as a supplement to grain without mash.

Procedure and Conditions: White Wyandotte pullets were used with 20 to the pen each year. Grit and oyster shell were available at all times. Fresh drinking water was available for all pens except the skimmilk pen. The grain mixture consisted of 70 parts corn and 30 parts oats.

Mash, where used, was kept in hoppers before the birds at all times. Skim milk, where used, was supplied ad libitum and no water was given. Condensed milk was fed at the rate of one pound daily to 16 to 20 hens, in the paste form, just as it came from the barrel. The grain was fed in the straw litter twice daily.

Feeds Used

	Pens					
	1	2	3	4	5	6
			Pounds			
Bran	5	5	*	5	*	5
Shorts	5	5	—	5	—	5
Corn meal	5	5	—	5	—	5
Ground oats	5	5	—	5	—	5
Meat scrap	5	—	—	—	—	—
Dried buttermilk	—	—	—	—	—	8
Skimmilk	—	**	**	—	—	—
Condensed buttermilk	—	—	—	***	***	—

*No mash used in Pens 3 and 5.

**Skim milk available at all times.

***One pound daily for 16-20 birds.

Results: Average Annual Feed Consumption and Egg Production Per Hen, Three Year Average

	Pens					
	1	2	3	4	5	6
Feed consumption per hen						
Grain, lb.	50	49	64	52	64	51
Mash, lb.	31	20	—	23	—	29
Milk, gal.	—	10	10	24	22	—
Eggs per hen:						
Winter	32	44	40	36	39	45*
Year	156	153	158	154*	159*	165

*Two-year average.

Reference: Agricultural Education Vol. 9, No. 8, April 1933, pages 117 and 118, tables 5 and 6, Clemson, South Carolina.

All Mash Versus Mash and Grain

Conducted by: Oklahoma Agricultural Experiment Station.

Conducted at: Stillwater, Oklahoma.

Period: 3 years, 1927-28, 1928-29, and 1929-30.

Purpose: To compare the feeding of laying mash in an all mash form versus feeding a more concentrated mash with grain for egg production.

Procedure and Conditions: Five pens of hens were used each year for three years. Each year the same pen received the same rations as the year before. The hens were Barred Plymouth Rocks and were hatched from eggs secured from one of the outstanding Barred Plymouth Rock breeders of the United States. Forty-eight pullets were started in each pen each year.

Pen 206 received mash with lights turned on at 4 A. M. and off at 7 A. M. from November 1 to April 1.

Pen 207 received mash and grain with lights turned on at 4 P. M. and off at 7 A. M. from November 1 to April 1.

Pen 208 received same ration as pen 206 but did not have lights.

Pen 209 received the same ration as pen 207, but did not have lights.

Pen 210 received the Standard A. & M. Laying ration without lights.

All pens had chopped alfalfa hay in wall racks all the time and in addition received a liberal daily feed of some other green feed. The mash used for pens 206 and 208 was 30 yellow corn meal, 40 kafir meal, 20 pulverized oats, 10 gray shorts, 20 bran, 12.5 meat scraps, 2.5 mineral.

These are the same ingredients as used in pens 207 and 209, except that it is all fine ground and fed in mash form, whereas in pens 207 and 209 part is fed as scratch grain and part as mash.

The mash used in pens 207 and 209 is 10 yellow corn meal, 10 kafir meal, 10 shorts, 20 bran, 12.5 meat scrap, 2.5 mineral.

The rations used in this project are of a quality that might not be expected to give the maximum production from a flock of hens. They are designed, however, to be uniform in all pens so that the method of feeding and management could be compared without the feed factors being considered.

Over the 10 month period beginning November 1 and ending August 31, during the years 1928-29 and 1929-30 the pens receiving lights in the morning to lengthen the day did not produce enough more eggs than the pens that did not receive lights to justify lighting. The year 1927-28 the lighted pens produced approximately two dozen more eggs per hen during the ten month period than the pens that did not receive lights. This was true with all mash and mash and grain.

Results: All Mash Versus Mash and Grain

Pounds of Feed Consumed and Number of Eggs Produced Per Hen for 10 Months Each Year					Egg Weights in Ounces Per Dozen		Average Weight of Hens in Pounds		
Pen	Total Feed	Grain	Mash	Eggs	Feb.	Mar.	Nov.	Apr.	Aug.
1927-1928									
206	72.97			148.94	21.46	21.16	4.65	4.90	4.94
207	65.98	38.45	37.53	155.4	22.05	21.57	4.75	4.93	4.76
208	66.28			123.41	21.92	21.04	4.60	4.78	4.74
209	64.10	39.51	24.59	119.57	22.09	21.02	4.59	4.60	4.51
210	66.96	39.83	27.13	121.48	24.12	22.12	4.04	4.61	4.27
1928-1929									
206	66.15			89.8	20.58	22.82	4.00	5.15	4.56
207	65.12	42.13	22.99	100.4	20.57	20.19	3.58	4.59	4.40
208	59.83			82.6	22.42	21.71	4.05	5.21	4.65
209	61.26	37.01	23.25	103.6	22.00	21.95	3.73	4.85	4.51
210	65.85	37.07	28.78	112.5	21.38	21.61	3.87	4.84	3.74
1929-1930									
206	64.27			105.1	23.50	23.17	4.36	5.29	4.76
207	69.92	33.81	36.11	113.3	23.56	23.75	4.36	5.37	4.82
208	59.97			96.8	24.16	24.17	4.21	5.23	4.90
209	70.34	36.91	33.43	105.4	23.94	24.09	4.18	5.02	4.77
210	65.74	35.52	30.22	97.3	24.68	23.96	3.96	4.87	4.58

Reference: Oklahoma Agricultural Experiment Station 1926-30 Report, page 96, 97, and 98, table 31, Stillwater, Oklahoma.

All Mash Versus Grain and Mash for Laying Hens

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: November 1927 through February 1928.

Purpose: To compare all mash and grain and mash for laying hens.

Procedure and Conditions: Four pens, each containing 100 pullets and five cockerels, were used in this experiment. Pens A and B contained Barred Plymouth Rocks and Pens C and D, Single Comb White Leghorns. These birds were all raised from the Experiment Station flock. Individuality and maturity were considered in dividing the pullets. At housing time, twenty pullets were selected in each pen to be weighed weekly during the first six months of the experiment.

The pullets were housed in an open front Kentucky shed roof poultry house. Each pen of 100 pullets was placed in a 20 ft. x 20 ft. section. The pullets were allowed access to grass yards except on very cold or rainy days.

Pens A and D received an all-mash ration, while Pens B and C received mash and grain. The mash mixtures are as follows:

	Pens A and D	Pens B and C
Ground yellow corn	650 lbs.	150 lbs.
Wheat bran	100 lbs.	100 lbs.
Wheat middlings	100 lbs.	100 lbs.
Meat scraps	75 lbs.	75 lbs.
Dried buttermilk	25 lbs.	25 lbs.
Ground limestone	20 lbs.	20 lbs.
Bone meal	20 lbs.	20 lbs.
Salt	10 lbs.	10 lbs.

The mash was kept before the birds in open hoppers at all times. Pens B and C received shelled yellow corn fed in the litter. The amount of corn fed, approximated the amount of mash eaten. By this method, the ingredients of each rations were kept close to the same level. One-third of the corn was fed in the morning and two-thirds in the late afternoon. Oyster shell and fresh water were available at all times.

Results: All Mash Versus Grain and Mash for Laying Hens

	Barred Rocks		Leghorns	
Treatment	Pen A	Pen B	Pen C	Pen D
Feed consumed per hen				
Grain		41.5	37.1	
Mash	85.0	42.7	44.6	77.7
Skimmilk	3.9	3.8	3.3	2.7
Total feeds with milk solid*	85.4	84.6	82.0	78.0
Nutritive Ratio of Grains & Mash Consumed	1:5.39	1:5.17	1:4.94	1:5.37
Eggs produced per hen				
Winter	54.6	54.7	55.4	59.4
Year	167.4	174.3	182.0	182.7
Number of deaths	9	9	6	8
Number culled	18	13	5	6

*A small amount of skimmilk was fed all pens in August to hold up summer production.

Reference: Kentucky Agricultural Experiment Station Bulletin 294, "Feeding Trials with Laying Hens", pages 189, 190, 191, 192, and 193, tables 14, 15, 16 and 17, April 1929, Lexington, Kentucky.

Molasses in Rations for Laying Hens

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge, Louisiana.

Period: Three years: The text extended over a period of ten months in each of first 2 years and for eight months the third year.

Purpose: To determine the effect of molasses in the rations of laying hens.

Procedure and Conditions: Thirty Single Comb White Leghorn pullets were used in each lot the first year, twenty-five per lot the second year, and twenty-four per lot the third year. Sisters and half-sisters were distributed in the several lots to overcome to some extent the bias that might result from breeding.

The birds were trap-nested throughout the tests and only those eggs laid in the trapnests were counted. The lots were housed in similar sections (12′ x 18′) of a laying house. Double yards were accessible to each lot, with a green feed crop available in the yard in use. The green feeds grown and used from October to May were Italian rye grass and white Dutch clover. Soybeans and Sudan grass, replanted at intervals of 3 to 4 weeks, were used as summer green feeds.

No artificial lighting was used in 1932-33, but morning lights were used from October through March the two following years.

All eggs laid during the first five days of January, February, March and April were weighed individually in grams on special Toledo egg scales. Average egg weight was determined for each hen for the season. Egg size for the lot was calculated, the egg size of the hen rather than a direct average of all eggs from a lot being used as a basis. The birds were weighed individually on the first of each month and average body weight per lot determined on that basis.

An adequate sample of eggs from each lot was set and fertility and hatchability results recorded. Post mortem examinations were made to check up on deaths attributable to nutritional disturbances.

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5*
Ingredients	Basal Ration	—5 Yel. C. M. +5 Molasses	—7.5 Yel. C. M. +7.5 Molasses	—10 Yel. C. M. +10 Molasses	
Yellow corn meal	50	45	42.5	40	45
Rice bran	12	12	12	12	12
Rice polish	12	12	12	12	12
Meat scrap (50% Pro.)	15	15	15	15	15
Dried buttermilk	5	5	5	5	5
Alfalfa leaf meal	3	3	3	3	3
Mineral Mixture	3	3	3	3	3
Blackstrap molasses	—	5	7.5	10	—
Dried molasses	—	—	—	—	5
	100	100	100	100	100

*Lot 5, dried molasses (Molaska) used only in 1934-35.

Laying ration mineral mixture: 6 parts pulverized oyster shell
3 parts bone meal
1 part salt

Oyster shell and grit as well as clean water were available ad libitum.

Results: Molasses in Ration for Laying Hens

					Hatching Record		
Lot No.	No. in Lot	Per cent molasses in ration*	Average feed consumed per bird	Eggs produced per bird**	Per cent fertile	Per cent hatch of fertile eggs	Per cent mortality of hens (a)
		Year of 1932-33 (Ten months—October 1 to July 31)					
1	29	0.0	77.2b	135.0	86.2	74.4	14.8
2	31	5.0	66.4	140.9	71.9d	77.9	20.7
3	28	7.5	82.2b	131.7	93.4	81.8	21.4
4	29	10.0	68.5	139.3	82.8	78.6	23.3
		Year of 1933-34 (Ten months—October 1 to July 31)					
1	25	0.0	65.6	138.0	88.0	88.0	20.8
2	25	5.0	67.6	134.8	90.6	88.5	28.0
3	25	7.5	67.5	145.1	78.2	79.9	29.2
4	25	10.0	69.0	145.3	88.7	90.8	25.0
		Year of 1934-35 (Eight months—October 1 to May 31)					
1	24	0.0	56.4	129.3	45.9	69.8	16.7
2	24	5.0	51.7	141.3	85.7	74.0	13.0
3	24	7.5	52.2	128.7	52.1	78.7	13.5
4	24	10.0	54.7	118.7	86.6	74.8	25.0
5	24	5.0c	52.6	142.2	53.8	88.1	13.6

*Blackstrap molasses replaced yellow corn meal, pound for pound, in all-mash rations.

**Calculated on a ten-day basis.

aAccidental deaths not included.

bThese figures should be discounted because rats consumed appreciable amounts of feed.

cDried molasses (Molaska). On a dry matter basis, equivalent to about 7.5 per cent blackstrap molasses.

dOnly one male was in this lot for most of the season, whereas two males were used in the other lots.

Reference: Louisiana Agricultural Experiment Station Bulletin 289, "Cane Molasses in Poultry Rations", pages 5, 6, 7, and 11, tables 1 and 4, August 1937, Baton Rouge, Louisiana.

THE USE OF LIGHTS IN WINTER

On the average farm hens are housed in many different ways. Some use the shade trees around the home, the barn, an open shed, and some have good poultry houses.

Under which housing condition would the hen normally produce the most eggs?

Why would a hen in a tight house produce more eggs than a hen roosting in a tree?

In a number of cases on the farm lights are being used with laying hens.

What kind of housing condition must be had to use lights successfully?

What is the purpose of using lights?

Is the use of lights profitable?

Force-Molting of Hens and All-Night Lighting As Factors in Egg Production

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Purpose: To determine the effect of force-molting of hens and all-night lighting on egg production.

Procedure and Conditions: Hens two and three years old, in good condition and carefully selected for uniformity, were used in testing the practice of force-molting and all-night lighting. The birds were divided into two pens.

In Pen 1, 150 hens in 1931 and 100 hens in 1932 were managed in the general manner approved by successful poultry raisers, without lights and with no attempt to force-molt. The birds in this pen had a good laying mash before them continuously, were allowed free range on seasonal green feed, were given scratch grain each evening, and in addition received a daily feed consisting of laying mash moistened with a limited amount of water and condensed milk.

In Pen 2 there were 242 hens in 1931 and 100 hens in 1932, housed in the same manner as the control group. The hens were force-molted. Force-molting should be done during the late summer or early fall and may be accomplished by radical changes in the feeding schedule and management of the birds. The laying mash in the hoppers should be replaced with shelled corn, and the birds given a moist fattening mash twice daily. The fattening mash may consist of equal parts of corn meal and laying mash, moistened with water or milk, or a regular fattening mash mixture may be fed. Three pounds, dry weight, of this mixture to each one hundred hens is approximately the proper amount for each feeding. It is advisable to put the birds on free range where plenty of succulent green feed is available; however, if the birds are confined, green feed should be liberally supplied in the house. This system of management should be continued until the hens have molted and are in good body weight, which will embrace a period of from two to four weeks, depending largely upon the physical condition of the birds. Birds having gone through one season of egg production are usually infested with round or tape worms, or both. The molt may be hastened and the body condition improved by treating the hens for worms before attempting to condition them.

After the hens have been molted they should be confined to the laying house and given a good laying ration to bring them into egg production. They should have access to all of the laying mash they will consume and should receive in addition a limited amount of grain daily. The scratch grain may consist of whole shelled corn or other grain mixtures. Egg production will be hastened if a moist feed, consisting of laying mash mixed with water or milk, is fed daily. The amount of moist mash fed should not be more than the birds will consume in fifteen or twenty minutes. All-night lights should be provided at the same time the birds are confined to the laying house for renewed production, otherwise the birds will not come into egg production and may go into a second molt. The birds should begin to come into egg production in about ten or fifteen days after the lights are turned on.

Method of Lighting: The purpose of artificial light in a poultry house is to attract the birds from the roosts, stimulate them to activity, and provide enough light for them to find the feed and water. The first requirement is that some light shall fall on the roosts. There is danger in providing too much light, thus preventing the birds from getting their required rest. The lights should be bright enough for the hungry birds to eat, yet dim enough for those that are not hungry to sleep. If electricity is available a ten-watt or fifteen-watt light for approximately one hundred hens is sufficient. This light should be placed about the center of the house where it will shine on the mash hoppers, water vessels, and roosts. Reflectors make the light more efficient and should be approximately four inches in depth by sixteen inches in diameter. The cost of lighting is very small, and should not exceed three cents per bird for the winter months. An increase in production of one egg per bird will normally pay for the additional cost of lighting. If electricity is not available, one kerosene lantern for each 100 hens may be used with good results. Every precaution should be exercised to reduce the fire hazard where lanterns are used. The house should be lighted just before dark, and remain lighted until daylight the next morning. This practice should be continued until about April 1, or until such time in the spring when the reduced price of eggs does not warrant the continuation of this method of management.

Results: **Influence of Force-Molting of Hens and All-Night Lighting on Egg Production, Fertility, and Bird Mortality**

	1930-31		1931-32	
	No molt No lights	Force-molt Lights	No molt No lights	Force-molt Lights
Duration of experiments	6 months		8 months	
Number of hens per pen	150	242	100	100
Eggs produced per bird	48	62	66	90
Per cent fertile eggs hatched	74.7	69.5	57.3	52.3
Per cent hen mortality	15.3	9.5	18.3	15.0

Reference: Alabama Agricultural Experiment Station Circular 64, "Force-Molting of Hens and All-Night Lighting as Factors in Egg Production", pages 4, 5, and 6, table 1, Auburn, Alabama.

The Effect of Artificial Lighting Upon Egg Production

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson, South Carolina.

Period: October 1 to February 28.

Purpose: To determine the value of artificial lights to stimulate egg production during the fall and winter months.

Procedure and Conditions: Single comb White Leghorn pullets were used in the test. "Morning lights", and "all-night" lights were compared with "no lights". The lights were used from October 1 to February 28. The amount of illumination for the various pens was as follows:

Morning lights: 2, 40 Watt electric lights per 20′ x 20′ house

All-night lights: 1, 15 Watt electric light per 20′ x 20′ house
No lights

The morning lights were turned on before day at such an hour depending upon the season, to provide approximately 14 hours of feeding time for the birds. The all night lights were turned on at 9:00 P. M. and allowed to burn until the following morning. The lights in each pen were equipped with a reflector 16 inches in diameter. The 15-Watt light in the all-night pen was located directly over the feeder and waterer.

Results: The Effect of Artificial Lighting Upon Egg Production

Factors Studied	Morning Lights	All-Night Lights	No Lights
Average number hens per pen	126	119	123
Average number eggs per pen	72.6	76.7	65.6
Total value of eggs	$183.06	$179.80	$155.89
Total feed costs	48.93	46.48	47.31
Returns over feed costs	134.13	132.32	108.58
Kilowatt hours electricity	38	24	0
Total value current	1.52	0.96	0
Net returns over feed and current costs	132.61	131.36	108.58
Value of lights	24.03	22.78	
Value of lights per hen	0.19	0.19	

Reference: South Carolina Agricultural Experiment Station Forty-Sixth Annual Report, pages 114, 115 and 116, table 35, December 1933, Clemson, South Carolina.

All-Night Light for Winter Egg Production

Conducted by: Ohio Agricultural Experiment Station.

Conducted at: Wooster, Ohio.

Period: December 3, 1929 to March 1, 1930.

Procedure and Conditions: The tests with all-night light in 1929 were conducted with four groups of yearling Leghorn hens which, as pullets, had been on other tests until September 3 of the previous year. At this time the hens were transferred to another house and carried on as one flock. The hens had previously been confined indoors but after moving they had access to a fairly good outdoor range. At the same time two parts of whole corn were added to one part of the all-mash feed mixture previously used. Oyster shells and chopped legume hay were kept before the birds at all times. This method of feeding and management was continued until December 3, when the best hens were removed for other tests. The remaining, more inferior hens were divided into four lots and given all-night or morning light. The feeding of whole corn was discontinued and followed by an all-mash-oats feed mixture composed of coarsely ground yellow corn, 45; coarsely ground wheat, 20; whole oats, 15; wheat bran, 5; meat scraps (medium), 10; dried milk, 5; poultry bone meal, 2; salt, 1; and cod-liver oil, 1. No additional grain or moist mash was fed. The group given all-night light laid a greater number of eggs in December and January, but in February the hens with morning light slightly exceeded the others. The better production in December for Lots 1 and 2 was due to the better grade of hens used. However, the better hens in this case were only second grade ones left after the best had been previously selected for other tests.

The hens not only laid well during the winter months but also increased their body weight. The average weight of Lot 3, with all-night light beginning December 3, was 3:45; January 1, 3.60; February 1, 3.68; and March 1, 3.75 pounds per bird. At the same time Lot 4, with morning light weighed 3.42, 4.14, 4.05, and 3.71 pounds respectively.

Eggs from Lots 3 and 4 were hatched weekly from January 20 to February 10. Those from Lot 3 were 84 per cent fertile, and 82.5 per cent of them hatched. The eggs from Lot 4 were 88.5 per cent fertile, and 80.2 per cent of them hatched.

Results: All-Night Light Versus Morning Light for Winter Egg Production

	Percent Egg Production			Eggs per Bird December 3 to March 1
	December	January	February	
1. All-night light, 40 hens	42	55	50	44
2. All-night light, 40 hens	48	50	46	42
3. All-night light, 60 hens	29	51	57	40
4. Morning light 4:30 A. M., 60 hens	18	46	60	36

Reference: Ohio Agricultural Experiment Station Bulletin 476, "All-Night Light for Layers", pages 4 and 5, table 3, May 1931, Wooster, Ohio.

RANGE VERSUS CLEAN YARD

The average farm flock of hens have access to free range. They are allowed to go where they please, and little consideration is given to providing any crops for grazing purposes, especially during the fall and winter months. During the spring and summer months the average farm hen is given very little feed because they have access to all the grass they want. And very often the question is raised, "Why aren't my hens laying more eggs?"

Could more grazing be supplied to hens?

What effect does pasture have on egg production?

Does pasture have any effect on the cost of producing eggs?

What type of grazing should be provided?

Is there a satisfactory substitute for pasture with laying hens?

A Comparison of Layers Ranged or Confined

Conducted by: Ohio Agricultural Experiment Station.

Conducted at: Wooster, and Carpenter, Ohio.

Period: 8 years, 1923-1930.

Purpose: To determine the effect of confining layers and allowing them fresh range.

Procedure and Conditions: This test has been in progress since 1923. Except for Tests 8 and 9, the pullets were raised on a good range before they were subjected to the various tests as layers. The birds had 3.5 to 4 square feet of floor space in the laying house, and the different ranges were such as would provide ample succulent green feed and the soil only moderately contaminated with disease or internal parasites.

The birds received the following basal rations:

ALL MASH: Tests 1 and 2

Ground corn	30
Ground oats	20
Ground wheat	20
Standard middlings	10
Bran	10
Meat scraps	10
Oyster shells and granite grit	

ALL MASH: Tests 3 and 4

Ground corn	65
Ground wheat	20
Meat scraps	10
Bone	4
Salt	1
Oyster shells and granite grit	

ALL MASH: Test 5

Ground corn	45
Ground wheat	20
Whole oats	20
Meat scraps	10
Dried buttermilk	5
Bone	2
Salt	0.5
Cod-liver oil	1
Oyster shells	5
Chopped alfalfa hay ad lib.	

Chicks and pullets raised indoors

ALL MASH: Tests 6 and 7

Ground corn	45
Ground wheat	20
Whole oats	15
Bran	5
Meat scraps	10
Dried buttermilk	5
Bonemeal	2
Salt	1
Cod-liver oil	1
Oyster shells	
Granite grit	
Chopped alfalfa ad. lib.	

ALL MASH: Tests 8 and 9

Ground corn	35
Ground wheat	20
Ground oats	20
Bran	7
Alfalfa	5
Meat scraps	8
Dried buttermilk	5
Salt	0.5
Cod-liver oil[1]	1
Oyster shells	
Granite	
Chopped alfalfa ad lib.	

[1] November 1 to April 1.

Results: Layers As Affected by Range or Confinement

Ranged or Confined	No. of Birds	Eggs Per Bird	Mortality	Body Weight
Test 1*—50 weeks, October 20, 1924—October 14, 1925				
Basal only, indoors	50	90	47	3.40
Basal plus chopped alfalfa	50	132	12	3.58
Basal plus 2 per cent cod liver oil	50	149	13	3.65
Basal plus liquid skimmilk	50	142	32	3.78
Basal plus range	50	163	8	3.60
Test 2**—48 weeks, October 30, 1924—September 30, 1925				
Basal only, indoors	50	92	42	3.58
Basal plus bare lot (20 x 20 feet)	50	122	26	3.65
Basal plus 2 per cent cod liver oil	50	139	16	3.75
Basal plus range	50	149	14	3.68
Test 3**—56 weeks, October 1, 1925—October 29, 1926				
Basal only, indoors	50	94	42	3.58
Basal p'us Soybean hay	50	142	26	3.70
Basal plus 2 per cent cod-liver oil	50	101	8	3.65
Basal plus range	50	171	14	3.86
Test 4**—44 weeks, October 14, 1926—August 17, 1927				
Basal plus chopped alfalfa hay, indoors	74	121	45	3.11
Basal plus chopped alfalfa hay and 2 per cent cod liver oil, indoors	74	94	49	3.33
Basal plus range	74	157	40	3.46
Test 5*—50 weeks, June 13, 1929—May 28, 1930				
Basal only, indoors	45	141	38	3.36
Basal plus range	45	153	48	3.52
Test 6*—50 weeks, September 20, 1928—September 4, 1929				
Basal, indoors	100	145	53	
Basal, wire sun porch	100	135	40	
Basal, range	100	132	54	
Test 7*—42 weeks, November 1, 1929—August 20, 1930				
Basal, indoors	100	117	70	
Basal, wire sun porch	100	110	60	
Basal, range	100	126	70	
Test 8*[1]—44 weeks, July 7, 1932—May 10, 1933				
Basal	50	80	71	
Basal, range	50	87	68	
Test 9*[1]—58 weeks, July 20, 1933—Aug. 31, 1934				
Basal, indoors	50	136	59	
Basal, wire sun porch	50	132	64	
Basal, bare yard	50	110	64	
Basal, range	50	157	36	

*At Wooster, Ohio.

**At Southeastern Experiment Farm, Carpenter, Ohio.

[1] Pullets brooded and grown indoors.

Reference: Ohio Agricultural Experiment Station Bimonthly Bulletin No. 171, pages 194 and 195, "Shall Layers Be Ranged or Confined", November-December 1934, Wooster, Ohio.

Pasture Study Comparing Results with Laying Hens on Dry Lot, Mustard, Italian Rye Grass and Oats

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Purpose: To compare the value of dry lot, mustard, Italian rye grass and oats for laying hens.

Procedure and Conditions: Each lot was composed of 25 laying hens equalized in respect to egg production, breeding, weight and general condition. All lots were fed the following all mash ration:

50 pounds yellow corn meal
20 pounds wheat shorts
20 pounds wheat bran
10 pounds shrimp meal
½ pound salt and oyster shell ad lib.

One lot had access to double yard range with 40 square feet per bird devoid of all green material. Three additional lots had the same range area in double yards, in which for one lot Japanese Tendergreen Mustard was kept available as much of the year as possible, another the same was true with Italian Rye grass and another the same with oats.

Average Days Grazing Available

Crop	Days
Mustard	151
Italian Rye Grass	215
Oats	200

Results: Average of Two Years Results*

	Annual Mortality	Average No. Birds	Total Eggs	Eggs Per Hen	Total Feed Lbs.	Feed Per Hen Lbs.	Food Per Dozen Eggs Lbs.	Percentage Reduction of Feed Per Doz.
Dry lot	11	19.38	4968	256	2913.5	150	7.037	——
Mustard	7.5	21.46	6524	304	3268	152	6.011	14.6
Rye grass	6	21.92	5797	264	2071.5	140	6.360	9.6
Oats	6.5	22	5848	266	3036	138	6.230	11.46

*Test still in progress.

Reference: Unpublished information, Poultry Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

The Efficiency of Alfalfa Leaf Meal and Alfalfa Meal as Substitutes for Green Feed in Rations for Laying Hens

Conducted by: New Mexico Agricultural Experiment Station.

Conducted at: State College, New Mexico.

Period: 1928-29 to 1930-31.

Purpose: To study the relative value of alfalfa meal, alfalfa leaf meal and green alfalfa for egg production on a year round basis.

Procedure and Conditions: Both alfalfa meal and alfalfa leaf meal were included in the study. Green alfalfa was used under two systems of management. In one case the birds were allowed free access to an alfalfa range; in the second case the alfalfa was cut green and fed to the birds daily.

In order to study all of the problems contained in this experiment it was necessary to provide four pens of birds. The first pen was kept on an alfalfa range. The other three had only a barren yard for a range. Of the three pens on barren yards, one was fed a mash containing 10 per cent of alfalfa meal, while the third pen was fed mash which contained no alfalfa meal, but was fed green cut alfalfa daily.

Each pen used in this test contained 25 White Leghorn pullets raised from the College flock. The usual precautions were taken to insure that each pen contained birds of as nearly equal quality as was possible. Late hatched pullets were used for this work, which delayed the starting of the experiment until December 1 of each year. Thus eleven months was as long as it was practicable to run each test.

The birds were housed in small colony houses, each located in a yard 50 x 100 feet in size. The barren yards were kept in that condition through occasional cultivation. They were not irrigated, which made it fairly easy under the dry climatic conditions to maintain a barren yard. The alfalfa range yard, of course, was irrigated. For about three months in the winter, December, January and February, this yard supplied only a very limited amount of green alfalfa. A larger range would have supplied some green feed throughout the winter. For the same length of time it was also impossible to supply Pen 4 with green cut alfalfa. During these three winter months these two pens were given late cutting alfalfa hay which had been soaked in water to give it a fresher appearance. The hay was bright green in color and when soaked, seemed to be the best substitute available for the green plant.

EFFECT OF AGE ON LAYING ABILITY

On the average farm of Mississippi hens are kept to a very unprofitable

Composition of the Rations Fed the Different Pens

	Pen 1	Pen 2	Pen 3	Pen 4
	Lbs.	Lbs.	Lbs.	Lbs.
Mash Mixtures	Bran 100 Shorts 200 Corn meal 100 Meat and bone meal 125 Salt 5	Bran 100 Shorts 200 Corn meal 100 Meat and bone meal 125 A'falfa leaf meal 70 Salt 5	Bran 100 Shorts 200 Corn meal 100 Meat and bone meal 125 Alfalfa meal 70 Salt 5	Bran 100 Shorts 200 Corn meal 100 Ground oats 100 Meat and bone meal 125 Salt 5
	Total 630	Total 700	Total 700	Total 630
Scratch Mixtures	Cracked yellow corn 100 Milo 100 Rolled barley 50	Cracked yellow corn 100 Milo 100 Rolled barley 50	Cracked yellow corn 100 Milo 100 Rolled barley 50	Cracked yellow corn 100 Milo 100 Rolled barley 50
	Total 250	Total 250	Total 250	Total 250
Range	Year round green alfalfa range	Bare yard	Bare yard	Bare yard. Cut green alfalfa was fed in amounts which, on a dry basis, equal the average amount of alfalfa consumed by Pens 2 and 3.

Results: Summary for the Three Years That the Experiment Was in Progress: Showing the Total Number of Birds Starting and Finishing the Experiment. The Percentage of Mortality, Total Number of Eggs Produced by Each Pen, The Average Production for Each Pen for the Three Years, and the Average Feed Consumption for Each Dozen Eggs Produced

Pen No.	Total number of birds starting experiment	Total number of birds finishing experiment	Percentage of Mortality	Total number of eggs produced per pen	Average egg production per bird for the eleven months based on number starting experiment	Average egg production per bird for the eleven months based on actual number in pen	Average pounds of Grain required to produce one dozen eggs
1	75	52	31	9734	129.8	150.7	5.1
2	75	45	30	8838	117.8	136.1	5.8
3	75	44	41	9187	122.5	153.1	5.4
4	75	38	49	8233	109.8	159.6	5.1

Reference: New Mexico Agricultural Experiment Station Bulletin 203, "The Efficiency of Alfalfa Leaf Meal and Alfalfa Meal As Substitutes for Green Feed in Rations for Laying Hens", pages 4, 5, 6, and 7, table 5, May 1932, State College, New Mexico.

age. In many cases the hen will be kept because she is a good brooder, and not considering very much the return that is being gotten from the hen. In many cases it would possibly be more profitable to give the hen away rather than trying to keep her. In most cases the age of the hen isn't known.

Should hens be marked so that their age might be kept up with?

Does a hen's age effect her laying ability?

How long should a hen be kept in a laying flock?

Hens Versus Pullets

Conducted by: Vineland International Egg Laying and Breeding Contest.

Period: Two years.

Procedure and Conditions: This test included all breeds represented at the egg laying contest, Plymouth Rock, Wyandottes, Rhode Island Red and Leghorns.

During the contest the birds consumed the following amounts of feed.

Breeds	Pullet Year Pounds	Hen Year Pounds
Plymouth Rocks	89.7	88.6
Wyandottes	80.3	80.4
Rhode Island Reds	86.5	86.5
Leghorns	76.1	79.9
Average	79.5	81.5

Results: Hens Versus Pullets

Breeds	Pullet Year Average No. of Eggs	Hen Year Average No. of Eggs
Plymouth Rocks	155.0	119.1
Wyandottes	144.3	115.4
Rhode Island Reds	150.6	117.2
Leghorns	169.7	137.6
Average	161.8	129.4

Reference: New Jersey Agricultural Experiment Station Hints to Poultrymen, Vol. 8, No. 1, October 1919, New Brunswick, New Jersey.

How Long Should Hens Be Kept?

Good hens may be kept at a profit two or three years for market eggs, and for breeding purposes even longer. Hens on the average give their greatest egg production the first or pullet year and diminish 15 to 20 per cent each succeeding year. The following figures give 3 years' records at the Kansas Agricultural Experiment Station for a number of White Leghorns, Rhode Island Reds, and Barred Plymouth Rocks:

Year	Rocks and Reds		Leghorns	
	Average Production	Per cent	Average Production	Per cent
1	170	100	198	100
2	140	82	151	76
3	104	61	120	61

Most of the second and third year's production is obtained during the spring and summer when eggs are cheap, therefore the net receipts from older hens will decrease faster relatively than egg production. The age of individual birds can easily be determined if the web between the toes is slit each spring when the chicks hatch, a different one of the sixteen possible combinations being used each year.

Reference: Kansas Agricultural Experiment Station Circular 147, "Culling Poultry", pages 30 and 31, Manhattan, Kansas, April 1929.

BREEDS—Do all breeds of chickens require the same amount of feed? Will all breeds of chickens produce the same number of eggs on a given amount of feed?

Feed Consumption by the Various Breeds

Conducted by: Maryland Egg Laying Contest in cooperation with Maryland Agricultural Experiment Station.

Conducted at: College Park, Maryland.

Period: Six years, November 1925 to October 30, 1931.

Procedure and Conditions: The greater part of the birds involved in these studies came from the state of Maryland, the nearby states of Pennsylvania and Virginia, and Michigan.

As one would expect in an Egg Laying Contest, the Single Comb White Leghorns predominated, there being 425 pens of the variety in the six contests. Rhode Island Reds were next with 69 pens, and Barred Plymouth Rocks were third with 42 pens.

All birds entered were required to be pullets, that is, hatched during the year in which they were entered. For the most part, they were hatched at the season of the year that would bring them into production about the time of the opening of the contest on November first. There was a small percentage of birds each year, however, that obviously were hatched early and had been in production for some time before arriving at the contest. Most of these were upset in the handling and shipping incidental to a change in location, causing them to cease production, temporarily, and go into a partial moult. A very few pens obviously immature on arrival and did not start production until late. No effort was made to get an exact history of the development of the pullets for such data would have been very difficult to obtain, under the circumstances and of doubtful accuracy.

The birds were fed by the dry mash and grain system throughout all six contests. The same formula for grain was used in all the contests, i.e., equal parts (by weight) of whole corn and whole wheat. The mash formula was changed once—at the beginning of the fourth contest. In the first three contests the mash was as follows:

Ration No. 1

Wheat bran	100 lbs.
Wheat flour middlings	100 lbs.
Ground No. 2 white oats	100 lbs.
Ground No. 2 yellow corn	100 lbs.
Meat and bone scrap* (50-55% protein)	100 lbs.
Salt	2½ lbs.

In the last three contests a change was made in the animal products portion of the mash, milk and cod liver meal being substituted for part of the meat scrap. The changed mash formula was as follows:

Ration No. 2

Wheat bran	100 lbs.
Wheat flour middlings	100 lbs.
Ground No. 2 white oats	100 lbs.
Ground No. 2 yellow corn	100 lbs.
Meat and bone scrap* (50-55% protein)	65 lbs.
Dried skimmed milk	25 lbs.
Cod liver meal (vacum dried)	10 lbs.
Salt	2½ lbs.

In all the contests, commercial crushed oyster shell, limestone grit, and medium sized granulated bone were kept before the birds in open hoppers.

For the most part, fresh greens were used throughout the whole year. Grass (lawn clippings), fresh cut clover or alfalfa, chick weed, and other weeds were used as available. Chick weed was obtained throughout the winter, except when covered by heavy snow or killed by severe freezing. Leafy alfalfa hay was used when fresh greens were not available.

Drinking water was kept in an open pan at one end of the dry mash hopper. The mash feeder was an open trough provided with a "flopping board" to keep the hens from getting in with their feet. It was placed in a well lighted part of the house.

The attempt was made to feed equal parts of mash and grain. A little more grain was fed in cold weather and during peaks in production. In the first two contests the grain was fed twice daily. In the balance of the contests but one feeding of grain was given, in late afternoon, varying from 4:30 P. M. on the shortest days to as late as 7:00 P. M. on the long days of summer. No artificial lighting was practiced in any of the contests.

In order to learn something of the influence of body weight on efficiency in production, all of the Leghorn pens were grouped into weight classes. It was the original intention to group by tenths of pounds but there were so many more birds in the middle groups, from 3.30 pounds to 3.90 pounds, that it was decided to cut these groups in half, by grouping in five hundredths of pounds. The weights used were the out going weights, taken during the last week in October, as the birds were cooped for shipment home. These weights were used rather than the "in" weights, because of the considerable variation in weight due to age and maturity, in the various pens at the start of the contest.

Results: Summary of All Breeds, Rated in Order of the Amount of Feed Consumed Per Dozen Eggs Laid. Average of all Six Contests

Breed	No. Birds*	Feed Consumed Per Bird	Feed Consumed Per Doz.	Percentage More Than W. Leghorns	Average Production
S. C. White Leghorn	4,781.17	80.470	4.800		201.08
R. C. Brown Leghorn	10.50	61.309	4.971	3.56	148.00
Ancona	57.11	73.394	5.436	13.25	162.04
Black Leghorn	11.38	69.975	5.472	14.00	144.64
Barred P. Rock	459.02	88.740	5.655	17.81	188.31
White P. Rock	49.39	83.686	5.730	19.38	146.12
Australorp	21.71	88.415	5.888	22.67	180.19
Rhode Island Red	655.58	92.200	6.130	27.70	181.00
S. C. Buff Leghorn	10.65	63.817	6.287	30.98	121.78
Lamona	9.69	74.407	6.495	35.31	137.36
Dominique	90.20	74.646	6.686	39.29	133.98
Silver L. Wyandotte	11.50	84.743	6.693	39.44	151.91
S. C. R. I. White	33.02	84.563	6.794	41.54	149.36
Andalusian	21.06	79.764	6.856	42.83	139.60
White Wyandotte	42.86	81.045	7.000	45.83	138.92
S. C. W. Minorca	10.40	80.481	7.581	57.94	127.40
Buff P. Rock	10.71	78.366	8.085	68.44	116.34
Mottled Brahma	10.94	77.203	8.184	70.50	113.16
Black Langshan	10.17	85.546	9.062	88.79	113.27
Jersey Black Giant	9.04	83.955	10.796	124.92	93.25

*Expressed as hen years.

Reference: Maryland Agricultural Experiment Station Bulletin 359, "Feed Consumption Studies Based on the Six Maryland Egg Laying Contests", pages 293, 294, 295, and 300, table 5, February 1934, College Park, Maryland.

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*Listed as Beef Scraps by most feed dealers.

SOYBEANS

in the Yazoo-Mississippi Delta

By H. A. YORK, Agronomist,
Delta Branch Experiment Station
Stoneville, Miss.

Bulletin No. 331 June, 1939

MISSISSIPPI EXPERIMENT STATION

CLARENCE DORMAN, Acting Director

State College, Mississippi

Summary and Conclusions

1. The Soybean, long a major crop in the Orient, is of increasing importance in the United States, and has a place in Delta agriculture. It can be grown for seed, for human feed, for forage and pasture, and to improve the soil.
2. Soybeans should be planted on a well prepared, well drained seed bed.
3. Soybeans may be planted alone, broadcast or drilled, or interplanted with corn or other forage or feed crops.
4. When planted for grain, drop approximately one seed per inch in rows 30 to 42 inches apart. Cover 1 to 1½ inches deep. The number of pounds of seed per acre varies with the seed-size of the variety used.
5. When planted for hay, drill, broadcast, or plant in rows at about 3 times the rate when planted for grain. Heavier seeding rates make finer hay
6. Plant April 15 to June 1 unless planted with corn earlier .
7. Inoculate seed when not certain that inoculation is already sufficient.
8. Best varieties for hay are Laredo, Avoyelles, and Otootan.
9. Best varieties for grain are Mamloxi, Delsta, Tokio, Mamredo, and Mammoth Yellow. The eight year average yield for the first three varieties is approximately 25 bushels per acre and about 19 bushels for the last two.
10. Cultivate as needed to keep down weeds and grass.
11. Harvest for grain with binder or mower when two-thirds of pods are ripe.
12. Harvest with combine for grain when all the pods are ripe. Use best equipment available.
13. Harvest soybeans for hay or plow under when the pods are forming.
14. Soybean hay should be handled carefully in order that the leaves may be preserved.
15. Northern varieties have not done as well as Southern or native varieties.
16. Soybeans are extremely susceptible to calcum arsenate and care should be exercised in dusting for boll weevil to avoid, as much as possible, the "drift" from the cotton fields.

Growing Soybeans in the Yazoo-Mississippi Delta

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Soybeans in the Hill Sections of Mississippi

"Growing Soybeans in the Yazoo-Mississippi Delta" presents data accumulated over a period of approximately twenty years concerning all major phases of soybean production.

Though the experimental work was conducted in the Delta and the bulletin is written from the Delta viewpoint, it is nevertheless applicable to major respects to other sections of Mississippi.

Certain differences may be noted, however, wherein conclusions and recommendations applicable to the Delta are not applicable to other portions of the state. It is suggested that farmers outside the Delta note these differences.

Soil Improvement—Investigations conducted by the Central Station at State College and by the several branch stations in hill sections of the state indicate that not a great deal of soil improvement may be expected where soybeans are interplanted with corn. It seems likely that the much more vigorous growth by soybeans on fertile Delta land accounts for the increased yields of cotton which follows soybeans, whereas the more moderate growth of the soybean plant on the less fertile soil of the hills similarly accounts for the lack of substantially increased yields of succeeding crops. It seems likely, also, that less leaching occurs under Delta conditions than in the hill sections.

Fertilizers—Delta soils usually contain an abundance of phosphorus and potash with only nitrogen required for optimum crop yield. Since the soybean is a leguminous plant and derives the major portion of its nitrogen from the air, no fertilization is recommended under the Delta conditions. In other areas, however, there is a deficiency of phosphorus and potash as well as of nitrogen, and on this account the use of 200 to 300 pounds of basic slag or half as much super-phosphate and 40 to 50 pounds of muriate of potash per acre is recommended.

Broadcast Planting—The broadcast planting of soybeans for hay is recommended under Delta conditions and is fully supported by experimental work. In other areas—and again probably because of less fertile soil—row plantings of all forage crops have yielded better than broadcast plantings .

Varieties—Three selections from Mamredo are shown to advantage in variety tests at State College and at Raymond. Average yields in bushels per acre for 1937 and 1938 at State College are: Vining Mamredo 1 27.4; Tokio 26.0; Vining Mamredo 2 25.6; Delsta 23.4; Erect Mamredo 20.4. Rokusun and Hahto were leading edible varieties, with two-year average acre yields as follows: Rokusun 14 5; Hahto 12.8.—Editor.

GROWING SOYBEANS

In the Yazoo-Mississippi Delta

By H. A. YORK, Agronomist,
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Stoneville, Mississippi

Within the past few years, soybeans have advanced from a minor position to one of major importance among the agricultural crops of the United States, and the phenomenal increase in acreage and production of soybeans in the cotton states indicates that the crop is destined to become one of considerable economic value in the South.

Origin of the Soybean

Though comparatively new in this country, the soybean is the most important legume grown in Oriental countries and during perhaps five thousand years it has furnished food for millions of people. It is of Asiatic origin and is a plant of ancient cultivation in China, Manchuria, Japan, Korea, to a much less extent in Northern India, and in the highlands of Java. Among these Asiatic countries the soybean has been a crop of prime importance so long that its real origin is lost in antiquity.

Soybeans were first cultivated in the United States about 1829, but attracted little attention until about 1854 when two varieties were brought from Japan by the Perry expedition. Other varieties were introduced from time to time, among them the Mammoth Yellow; and following the introduction of this variety the soybean has become an important crop in the United States. Between 1900 and 1910 the United States Department of Agriculture introduced about 250 varieties from the Orient. W. J. Morse of the Bureau of Plant Industry reports that varieties of soybeans are more numerous than varieties of cereal grains. Also he reports that ten years ago the United States Department of Agriculture had tested out upward of 800 varieties. Since that time Mr. Morse spent two years in the Orient studying and collecting varieties that he thought might be adaptable to the United States. Many of these varieties and selections have been tested at the Delta Experiment Station in the course of the regular breeding and testing program.

The soybean is a leguminous grain as well as a forage crop, possessing an advantage over other grain crops in not depleting the soil of the nitrogen which, being used by most plants in larger quantities than any of the other essential soil elements, is usually the first element to become deficient in the soil. The soybean is a valuable crop in many ways. High yields of grain and the increasing possibilities for industrial uses, the excellent quality of its forage, its soil building qualities, the ease of growing and harvesting, its comparative freedom from insect enemies and plant diseases, and its wide soil and climatic adaptation—all encourage more extensive planting of this crop.

Soybeans in the United States

The present importance of soybean production in the United States is shown by the increase in the total acreage of beans planted and harvested, and the total farm value of the crop in the last ten years. The United States Department of Agriculture, Agricultural Statistics for 1938, page 252, states that the total acreage planted in 1927 was 2,057,000 acres and in 1937 6,139,000 acres an increase of 4,082,000 acres or 198%. Total harvested for beans in 1927 was 567,000 acres and in 1937 2,337,000 acres, an increase of 1,770,000 acres or 310%. Total farm value in 1927 was $12,691,000 and in 1937 $37,619,000, an increase of $24,928,000 or 196%. There were 3,802,000 acres used for hay, green manure, pasture, soiling, etc. Mississippi is well adapted to the growing of soybeans for forage and for grain and the acreage seeded to the crop has materially increased during the decade. A further increase is indicated.

Purpose of this Bulletin

As with other crops, failures or near failures may be experienced in the growing of soybeans, especially by those who have not previously engaged in its production. Unsatisfactory results may be due to a number of causes including adverse weather conditions, the use of low yielding or unadapted varieties, and the employment of poor methods of culture, harvesting, and utilizaton. Unquestionably, soybeans can be successfully grown in most sections of the South where proper varieties and proper methods are employed.

Since 1921, the Delta Branch Experiment Station has conducted a wide range of experimental work which has included all major phases of soybean production and farm utilization. Information resulting from this work is presented in this bulletin in order that farmers may base their operations upon a knowledge of essential facts which insure successful production.

I. Soybean Production: Methods of Planting, Culture, and Harvest

Preparation of the Seedbed

Seedbed preparation for soybeans is similar to that for corn or cotton. Soybeans like most other cultivated crops readily respond to extra soil preparation. The land should be plowed early and deep and then cultivated at intervals until the beans are planted in order to destroy early weed growth. At the Delta Station good crops have been produced on land which had been thoroughly disked, but the plants appeared to be better able to compete with weeds when a good deep seedbed had been prepared. The seedbed should be in good tilth whether deep or shallow. Soybeans like other cultivated crops should not be planted among clods. Those planted early should be on low beds to insure local drainage, especially if planted on low land.

Inoculation of Soybeans

Soybeans, like other legumes, are able to utilize the free nitrogen of the air and use it in their growth by the action of bacteria in the nodules on the roots of the plants. These bacteria, whose presence is indicated by the development of nodules on the roots, cooperate with the soybean plant in taking nitrogen from the air, and are essential to successful production.

On fertile soils soybeans may make satisfactory growth and yields in the absence of inoculation, in which event the nitrogen required for plant growth may be taken from the soil rather than from atmospheric nitrogen. Most soils, however, are not sufficiently fertile to produce good yields without inoculation. A pale greenish yellow plant of small size, is an indication of lack of nodulation. As nodulation takes place, the plant becomes darker green and more vigorous. Therefore, in order to secure maximum yields, if the soil does not already contain the bacteria, the seed should be inoculated before planting.

Throughout the Delta the proper bacteria for soybeans seems to be widely distributed so that natural inoculation now occurs rather generally. It is much safer to inoculate, and the cost of inoculation is too small to justify the risk on land not definitely known to be inoculated. Inoculation of soybean seed is good crop insurance, either where they are being grown on land for the first time or where there is any doubt that the soil contains an abundant supply of the proper bacteria.

There are several methods of inoculating soybeans, including commercial cultures of soybean bacteria, soil transfer, and the muddy water method.

Cultures for inoculating soybeans may be purchased from seed firms or from some state agricultural experiment stations. Directions for use are supplied the purchaser.

With the soil transfer method, bacteria are carried from one field to another through the transfer of soil. Several hundred pounds of inoculated soil from a field on which an excellent crop of soybean has been recently grown, should be spread upon each acre of the field in which inoculation is desired. This method is effective but is objectionable because of the cost of hauling large quantities of soil and the possibilities of introducing weed seed and plant diseases.

Another soil method is to take about one gallon of finely sifted inoculated soil and dry and pulverize in the shade, then mix with about one bushel of soybeans, and plant.

The muddy water method is as follows: take a quantity of well inoculated soil from a field that has previously grown well inoculated soybeans. Add an equal amount of water and stir until all the lumps of soil are broken up or dissolved, shake, let stand five minutes, and use the muddy water above the soil. Thoroughly wet the beans with this muddy water, making sure that the seed are stirred until every bean is moistened.

With any kind of inoculation, the seed should be planted immediately. It is necessary to avoid direct sunlight from the time they are inoculated until they are planted.

Method of Planting

The method of planting soybeans depends to some extent on whether they are to be grown for seed, hay, pasture, soil building, or soiling crops.

When grown for seed in the Delta they are usually planted in rows and cultivated as other field crops. An ordinary corn planter equipped with proper plates is satisfactory. For interplanting soybeans with corn, duplex hoppers are most satisfactory. A grain drill can be used for seeding either wide rows or in close drills by covering the seed cups to adjust the width of row. Rows are usually placed 30 to 42 inches apart, and whether the soybeans are planted alone or with corn, the rows should be wide enough to work conveniently.

If a suitable planter or drill is not available, the seed may be broadcast by hand and disked in lightly. However, if the land is free from weeds and the crop is to be used for hay, broadcasting the seed will result in a forage of

TABLE 1—PERCENTAGE OF SEED GERMINATED 10 DAYS AFTER PLANTING AT VARIOUS DEPTHS

Variety	Depth Planted in Inches						
	¾	1	1½	2	2½	3	4
Laredo	100	100	100	90	85	60	30
Mammoth Yellow	75	100	100	94	48	48	28
Mamredo	100	100	98	98	46	46	31
Delsta	67	100	100	100	42	42	24

finer quality. When broadcast a greater amount of seed will be required. The growth of weeds in cold wet seasons is usually greater, and this point should be considered when planting.

Depth of Seeding

The depth of planting soybeans is very important. Failure to get stands is often caused by planting too deep. A depth of from one to one and one-half inches is usually sufficient and in no case should the depth exceed two inches except on light sandy soil. With shallow planting chances of failure due to crust formation is lessened after hard beating rains. Plantings about an inch deep are more likely to produce stands than those made at other depths. In a test under favorable conditions with the Laredo, Mammoth Yellow, Mamredo, and Delsta varieties, 100 seed of each were planted ¾, 1, 1½, 2, 2½, 3, and 4 inches respectively. The percentage of plants emerging ten days after planting are shown in table 1.

Rates of Seeding

The rate of seeding soybeans depends upon the variety, the method of seeding, and the purpose for which the crop is grown. Three years' results of a rates of seeding test for grain with four varieties, Virginia, Laredo, Biloxi, and Otootan, are shown in Table 2. The Laredo was planted at the rate of 6, 9, 12, 15, and 18 pounds per acre in 3-foot rows. The other varieties were planted so as to have approximately the same number of beans per acre as the Laredo at the above rate.

In seed production it is well to plant the beans in rows 32 to 40 inches apart, with approximately one bean to the inch in the drill, and cultivate as needed.

A second experiment was made to obtain information regarding the amount of seed required to obtain optimum

TABLE 2—RATES OF SEEDING SOYBEANS FOR HAY AND ACRE YIELD OF DRIED HAY

Variety	Rate of Seeding (Pounds)	Bushels per Acre 1926	1927	1928	3-Year Average
Virginia	11	7.0	11.1	24.4	14.2
Virginia	17	8.4	12.1	15.2	11.9
Virginia	22	13.3	12.3	10.3	11.9
Virginia	28	15.4	12.5	27.1	18.3
Virginia	33	17.0	12.5	27.5	19.0
Laredo	6	11.4	10.7	15.1	12.4
Laredo	9	11.9	9.2	18.3	13.1
Laredo	12	14.6	12.7	19.8	15.7
Laredo	15	14.1	10.7	18.8	14.5
Laredo	18	18.0	11.7	17.8	15.8
Biloxi	20	16.2	14.2	23.3	17.9
Biloxi	30	15.3	8.9	19.4	14.3
Biloxi	40	16.3	12.1	24.8	17.7
Biloxi	50	16.0	13.2	21.7	17.0
Biloxi	60	17.0	13.8	25.2	18.7
Otootan	8	14.1	12.1	14.4	13.5
Otootan	11	12.3	12.5	15.0	13.3
Otootan	15	14.0	12.1	17.3	14.4
Otootan	19	16.7	11.5	16.0	14.7
Otootan	23	13.2	12.2	18.8	14.7

In 1927 and 1928 George Washington was used in place of Virginia.

In 1927 and 1928 Tanloxi was used in place of Otootan.

TABLE 3—RATES OF SEEDING SOYBEANS FOR HAY AND ACRE YIELD OF DRIED HAY

Variety	Lbs. Planted per A.	Pounds Per Acre 1931	1932	1933	1934	1935	1936	1937	1938	8-Year Average
Laredo	40	5848.0	4535.3	4944.5	3100.0	5440.0	6612.0	10000.8	3145.7	5453.3
Laredo	52	5644.0	4296.6	4739.9	4522.0	4624.0	6220.0	10216.5	3387.7	5456.3
Laredo	56	5304.0	4876.3	4501.2	4522.0	5304.0	6200.0	9374.4	4274.9	5544.6
Laredo	60	6256.0	4330.7	4398.9	3162.0	4828.0	5722.0	10227.6	4274.9	5400.0
Laredo	80	5916.0	4364.8	4433.0	4352.0	5032.0	5794.0	10497.6	4678.2	5633.5
Geo. Wash.	122	5984.0	4671.7	5865.2	5236.0	4352.0	6110.0	11934.0	3589.3	5967.8
Geo. Wash.	158	6256.0	4876.3	4978.6	5134.0	4216.0	5526.0	11502.0	3629.7	5764.8
Geo. Wash.	171	5608.0	4569.4	5558.3	6052.0	4352.0	5738.0	11414.8	6291.4	6198.0
Geo. Wash.	183	5780.0	4535.3	4876.3	4318.0	4624.0	4616.0	12430.8	6654.4	5979.4
Geo. Wash.	244	5780.0	4944.5	6820.0	5032.0	3944.0	5162.0	11793.6	5525.2	6125.2
Tanloxi	121	5576.0	3614.6	3375.9	5270.0	6800.0	5076.0	10838.9	5323.5	5734.4
Tanloxi	158	4896.0	3375.9	4262.5	5372.0	7752.0	4632.0	11255.8	4234.6	5722.6
Tanloxi	170	5304.0	3819.2	4057.9	4930.0	5984.0	4584.0	11718.0	4678.2	5634.4
Tanloxi	182	4692.0	3853.3	3819.2	4692.0	7480.0	4506.0	11614.2	4073.3	5591.3
Tanloxi	243	4964.0	4964.0	4057.9	4364.8	5848.0	5064.0	11612.2	4516.9	5674.0
Biloxi	166	5576.0	4603.5	8559.1	4182.0	7480.0	5976.0	10897.2	3468.3	6342.8
Biloxi	216	5608.0	4023.8	3375.9	5372.0	69.36.0	6728.0	11113.2	4516.9	5959.2
Biloxi	232	5508.0	3682.8	7911.2	4760.0	6392.0	6432.0	12387.6	4395.9	6433.7
Biloxi	249	5644.0	3580.5	4467.1	4216.0	6664.0	6966.0	11858.4	5081.5	6059.7
Biloxi	326	5848.0	3887.4	4228.4	4658.0	7072.0	6418.0	11955.6	4960.5	6128.5

TABLE 12—NUMBER BEANS PER POUND AND RATE OF SEEDING FOR ROW AND BROADCAST PLANTINGS

Variety	No. Beans per Pound	Planted Broadcast 80 Pounds Laredo	Planted Broadcast 60 Pounds Laredo	Planted in 40-Inch Rows 15 Pounds Laredo	Planted in 40-Inch Rows 10 Pounds Laredo
Laredo	7775	80.0	60.0	15.0	10.0
Peking	6388	97.4	71.5	18.3	12.2
Otootan	5167	120.4	90.5	22.6	15.0
Chiquita	5006	124.3	93.2	23.3	15.5
Kingwa	4434	140.3	105.2	26.3	17.5
Looney No. 2	4417	140.8	105.6	26.4	17.6
Charles	4295	144.8	108.6	27.2	18.1
Tanner	4227	147.1	110.4	27.6	18.3
Creole	3890	159.9	119.9	30.0	20.0
Monetta	3844	161.8	121.4	30.3	20.2
Georgian	3831	162.4	121.8	30.4	20.3
Mamotan	3643	170.7	128.1	32.0	21.3
Avoyelles	3625	171.6	128.7	32.2	21.4
Pee Dee	3611	172.3	129.2	32.3	21.5
Unknown	3551	175.2	131.4	32.8	21.9
Palmetto	3532	176.1	132.1	33.0	22.0
Mamredo	3524	176.5	132.4	33.1	22.1
Mamloxi B. P.	2984	208.4	156.3	39.4	26.1
Nanking	2839	215.6	164.1	41.1	27.4
Delnoshat	2642	235.4	175.6	44.1	29.4
Tokio	2624	237.0	177.8	44.4	29.6
Tanloxi	2562	242.8	182.1	45.5	30.3
George Washington	2551	243.8	182.9	45.7	30.5
Yellow Biloxi	2506	248.2	186.2	46.5	31.0
White Biloxi	2408	258.3	193.7	48.4	32.3
Looney No. 3	2115	294.1	220.6	55.1	36.8
Biloxi	1875	326.4	248.8	62.2	41.5
Delsta	1860	334.4	250.8	62.7	41.8
Mammoth Brown	1855	335.3	251.5	62.9	41.9

yields of hay and the effect of different rates upon the quality of hay grown under Delta conditions.

Four standard varieties, Laredo, George Washington, Tanloxi, and Biloxi, were grown. Five rates of seeding were used, including 40, 52, 56, 60, and 80 pounds per acre for Laredo, and rates for the other varieties to give an equivalent number of seed and a corresponding number of plants per acre. The Laredo and Tanloxi are viney or semi-viney varieties and George Washington and Biloxi are upright in their growth habits.

For an eight-year period there was not a great deal of difference in the hay yield, but the heavy seeding rate gave a better quality hay. The diameter of the soybean stalks was lessened with the heavier rates of seeding, thus producing hay with finer stems. The yields of hay from 1931 to 1938 and an eight-year average are shown in **Table 3**.

A full stand of soybeans is absolutely essential to success. This is especially true where weeds or grasses are an im-

TABLE 4—YIELD OF GRAIN PER ACRE FROM EXPERIMENT WITH DATES OF SEEDING SOYBEANS

		Yield in Bushels per Acre				
Variety	Date Planted	1924	1925	1926	2-Yr. Av. 1925-26	3-Yr Av. 1924-26
Virginia	March 15	....	6.59	....	....	....
Virginia	April 1	....	9.68	....	....	....
Virginia	April 15	....	17.32	....	....	....
Virginia	May 1	....	14.60	12.11	13.36	....
Virginia	May 15	....	14.32	12.16	13.24	....
Virginia	June 1	....	10.69	4.64	7.67	....
Virginia	June 15	....	4.02	7.20	5.61	....
Virginia	July 1	....	8.90	2.03	5.47	....
Virginia	July 15	....	....	4.03	....	....
Laredo	March 15	....	11.58	7.78	9.68	....
Laredo	April 1	....	11.97	8.82	10.40	....
Laredo	April 15	....	9.99	7.79	8.89	....
Laredo	May 1	11.30	16.91	9.16	13.04	12.46
Laredo	May 15	11.03	15.95	16.37	16.16	14.45
Laredo	June 1	10.28	9.09	15.05	12.07	11.47
Laredo	June 15	....	8.56	14.28	11.42	....
Laredo	July 1	....	9.09	7.69	8.39	....
Laredo	July 15	....	....	4.57	....	....
Biloxi	March 15	....	15.29	7.00	11.15	....
Biloxi	April 1	....	9.87	9.28	9.58	....
Biloxi	April 15	....	12.65	11.70	12.18	....
Biloxi	May 1	12.09	16.21	9.83	13.02	12.71
Biloxi	May 15	10.46	15.38	13.69	14.54	13.18
Biloxi	June 1	12.15	9.69	10.77	10.23	10.87
Biloxi	June 15	....	8.71	10.78	9.75	....
Biloxi	July 1	....	16.15	5.49	10.82	....
Biloxi	July 15	....	....	3.25	....	....
Otootan	March 15	....	9.00	8.50	8.75	....
Otootan	April 1	....	16.67	12.56	14.62	....
Otootan	April 15	....	15.96	11.57	13.77	....
Otootan	May 1	4.74	10.47	12.49	11.48	9.23
Otootan	May 15	4.70	8.72	12.94	10.83	8.79
Otootan	June 1	7.62	3.10	9.86	6.44	6.83
Otootan	June 15	....	3.70	8.96	6.33	....
Otootan	July 1	....	3.46	5.49	4.48	....
Otootan	July 15	....	....	2.58	....	....

portant factor. In 30 to 40 inch rows it is essential to plant at least from 30 to 50 pounds of such varieties as Mamloxi and Tokio. With cheap seed, 50 to 60 pounds will pay. When planting broadcast, three to four times as much seed should be used as when planting in rows. Where weeds are not a factor, broadcast seeding is quite satisfactory if the ground is warm and the seed bed is freshly and well prepared.

Dates of Seeding

Soybeans may be safely planted any time after March 25, and until July 15, but under favorable conlitions the medium early planting produces larger yields of hay and grain than either extremely early or extremely late plantings. The best planting dates in Yazoo-Mississippi Delta under ordinary conditions are from April to June or after the soil has become thoroughly warm, as conditions then are most favorable for best germination and rapid growth of the crop. Low germinaton and slow growth may be expected in a cold, wet, or dry soil.

TABLE 5—YIELDS OF HAY FROM EXPERIMENT WITH DATES OF SEEDING SOYBEANS FOR HAY

Variety	Date of Planting	Pounds of Hay per Acre				
		1930	1931	1932	2-Year Average	3-Year Average
George Washington	March 15	4170	7446	4250	5848	5289
George Washington	April 1	5050	7888	6154	7021	6364
George Washington	April 15	4950	8024	4386	6205	5787
George Washington	May 1	4600	8228	2380	5304	3689
George Washington	May 15	5050	8908	2516	5712	5491
George Washington	Jpne 1	*	5406	4488	4947	....
George Washington	June 15	*	4080	2006	3043	....
George Washington	July 1	*	2856	2448	2652	....
George Washington	July 15	*	2414	1496	1955	....
Laredo	March 15	6260	7140	5542	6341	6314
Laredo	April 1	6800	8228	4658	6443	6562
Laredo	April 15	5650	8296	4522	6409	6156
Laredo	May 1	5800	7276	4284	5780	5787
Laredo	May 15	5650	6868	2249	4559	4922
Laredo	June 1	*	4624	2754	3689	....
Laredo	June 15	*	4114	2788	3451	....
Laredo	July 1	*	2346	2584	2465	....
Laredo	July 15	*	2244	2584	2414	....
Tanloxi	March 15	6700	7276	5032	6154	6336
Tanloxi	April 1	6900	8296	4318	6307	6505
Tanloxi	April 15	6150	7480	4046	5763	5892
Tanloxi	May 1	6200	9112	4896	7004	6736
Tanloxi	May 15	6200	7616	6120	6868	6645
Tanloxi	June 1	*	8160	3128	5644	....
Tanloxi	June 15	*	5372	2652	4012	....
Tanloxi	July 1	*	2720	2720	2720	....
Tanloxi	July 15	*	2312	2720	2516	....
Biloxi	March 15	*	7412	4488	5950	....
Biloxi	April 1	*	6868	3944	5406	....
Biloxi	April 15	*	7208	2406	4807	....
Biloxi	May 1	*	7956	5916	6936	....
Biloxi	May 15	*	6120	4080	5100	....
Biloxi	June 1	*	4794	3672	4233	....
Biloxi	June 15	*	4420	2380	3400	....
Biloxi	July 1	*	3128	3536	3332	....
Biloxi	July 15	*	2992	2312	2652	....

*No Stand.

TABLE 9—YIELDS OF DRY SOYBEAN HAY FROM ROW AND BROADCAST PLANTINGS

	Pounds per Acre Yield of Hay in											Dry Matter Av. Per Cent	
Variety	1930	1931	1932	1933	1934	1935	1936	1937	1938	9-Year Average	8-Year Average	9-Year Average	8-Year Average
						Planted in 40 Inch Rows							
Laredo	5200.0	538.6	517.1	1193.4	600.0	2080.8	1795.2	5899.0	2177.8	2222.4	2228.0	25.78	26.19
Mamredo	5575.0	532.4	520.2	1588.1	673.2	1672.8	2611.2	5937.8	2903.7	2446.1	2388.9	30.09	30.75
Otootan	5875.0	526.3	520.2	1373.9	740.5	2488.8	2448.0	6052.3	2339.1	2484.9	2503.1	27.01	27.57
Delsta	6100.0	556.9	520.2	1162.8	918.0	2815.2	2695.2	6875.3	2823.1	2718.3	2705.2	26.64	26.47
Mammoth Yellow	6200.0	532.4	489.6	1193.4	670.1	2937.6	2692.8	6540.5	2742.4	2666.5	2657.1	28.53	28.62
Biloxi	6650.0	508.0	550.8	1028.2	737.5	2835.6	1861.8	5078.2	....	....	2408.1	....	27.43
George Washington	4125.0	514.1	572.2	1468.8	804.8	999.6	2692.8	5579.3	....	....	2094.6	....	29.49
Tanloxi	6700.0	556.9	541.6	960.8	685.4	2733.6	2366.4	6192.7	....	....	2592.1	....	24.94
Tokio	....	....	....	....	....	2815.2	2203.2	6300.7	....	....	....	....	....
Mamotan	....	....	....	....	....	....	....	....	2016.5	....	....	....	....
Avoyelles	....	....	....	....	....	....	....	....	2419.8	....	....	....	....
						Planted Broadcast							
Laredo	5975.0	7548.0	4216.0	4250.0	4964.0	3672.0	7888.0	9663.8	3307.0	5720.4	6022.1	27.97	28.77
Mamredo	6735.0	8432.0	4556.0	5440.0	3774.0	2856.0	8432.0	10143.4	3468.3	5981.9	6296.1	29.84	30.59
Otootan	6050.0	7956.0	5440.0	5100.0	5882.0	7208.0	8160.0	8687.5	3629.7	6457.0	6810.4	25.23	25.65
Delsta	5650.0	7956.0	4148.0	5338.0	4658.0	3808.0	7616.0	11134.8	4274.9	6064.9	6288.6	29.17	29.42
Mammoth Yellow	5275.0	7888.0	4590.0	4690.0	5066.0	6936.0	7616.0	10679.0	4758.9	6389.0	6592.8	26.92	26.86
Biloxi	7625.0	7752.0	3842.0	4658.0	5338.0	8976.0	8160.0	11048.0	....	....	7174.9	....	25.18
George Washington	5450.0	7684.0	5066.0	6052.0	2584.0	6392.0	8976.0	6842.9	....	....	6130.9	....	27.24
Tanloxi	7425.0	7140.0	4080.0	3910.0	4284.0	4637.6	6256.0	10869 1	....	....	6075.2	....	24.38
Tokio	....	....	....	....	....	4216.0	8704.0	7884.0	....	....	....	....	....
Mamotan	....	....	....	....	....	....	....	....	3629.7	....	....	....	....
Avoyelles	....	....	....	....	....	....	....	....	3952.3	....	....	....	....

Delnoshat was used in place of Mammoth Yellow in 1933 and in place of Biloxi in 1934. Mamloxi was used in place of Mammoth Yellow in 1934, 1935, 1936, 1937 and 1938.

The rate of planting in rows using Laredo as a standard, 15 to 20 pounds per acre, and other varieties in the same proportion to the size of the beans to give the same number of beans per acre as Laredo. In broadcast from 60 to 80 pounds per acre with the other varieties in the same proportion. The broadcast has given better than a third increase over the row planted in an eight and nine year average. The row planting was cultivated two and three times and the big weeds were kept out with hoes. For hay, where weeds are not a problem, we recommend broadcast planting. Be sure and have a well prepared seedbed. Plant about the middle of April and your beans will be ready to cut for hay by the last of August.

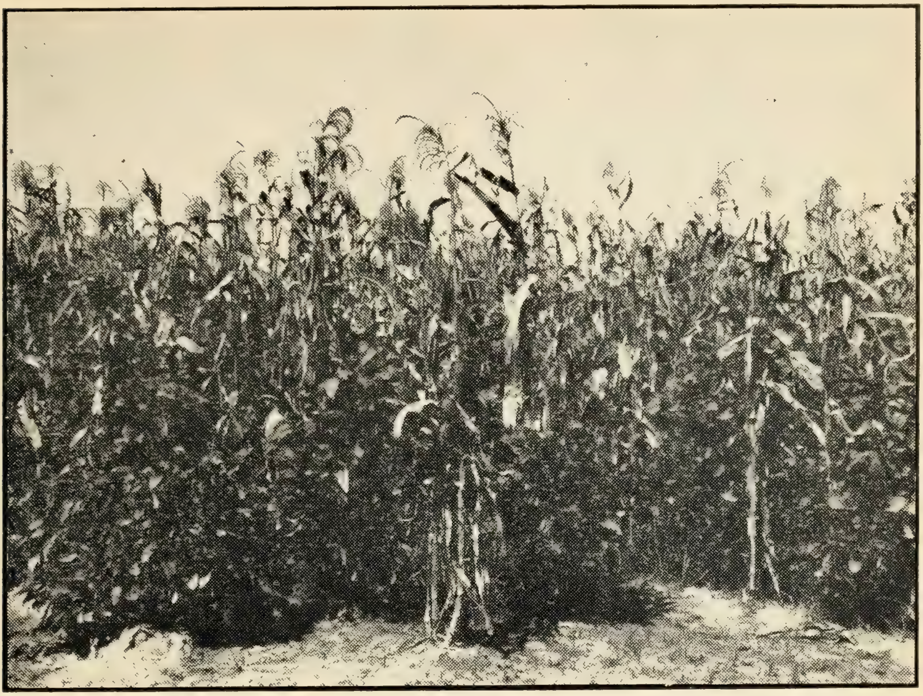


FIGURE 1—SOYBEANS AND CORN INTERPLANTED, PHOTOGRAPHED AUGUST, 1938.

Thorough preparation of seed bed to free the soil of weeds and grass and a slightly delayed planting date is very essential to growing a satisfactory crop of soybeans. Early seeding requires longer than late seeding to mature. The results at the Delta Station show that stands were reduced or destroyed by cold weather when seeded unseasonably early and the stands of late seedings were often weak or failures due to dry weather. The yield of soybean grain from a date of planting experiment is shown in Table 4.

The two and three-year average yields show that April 1 to May 15 are the best dates to plant soybeans for grain yields. The yields of hay from the experiment with Dates of Planting for Hay are shown in Table 5 and indicate that best results may be obtained for hay in seedings made from March 15 to May 15.

II. Utilization of the Soybean for Feed and Food and for Industry

Soybeans may be grown satisfactorily in combination with other crops, thus affording a greater variety and a large yield of forage. Grain sorghum and soybeans make a good combination for both pasture and forage. Soybeans planted in alternate hills with sagrain will make an abundant yield and the quality of forage will also be materially improved by the soybeans. Soybeans replace part of the nitrogen taken out of the soil by the grain crop.

Soybeans Planted In Corn

Unless there is good reason why it should not be done, every acre of Delta corn should be planted with soybeans at planting time—every hill of corn should have a hill of soybeans on each side of it. Previous work at the Delta Station indicates that more grain will be produced per acre on good land when corn and soybeans are planted together at planting time, than when corn is planted alone. A rank growth of soybeans is obtained when planted with corn in the Delta, and if turned under enriches and adds humus to the soil. This rank soybean growth has an additional advantage. It will crowd out and smother many late growing noxious weeds, leaving the field cleaner for the following season's crop than where corn is planted alone.

If corn and soybeans are planted in the same row, the duplex hopper, which drops corn from one side and beans from the other, is a very satisfactory and economical method of planting. Plates may be obtained for various types of planting which will either drop corn and beans in alternate hills, or in the same hill, or drop the corn in hills and drill beans continuousy, or drill both corn and beans. The soybean attachment to the corn planter is also a satisfactory method of planting soybeans and corn. Another good method is to plant corn with a check-row planter and later plant the beans between the corn hills or put the beans in with a hand planter one way between the hills of corn. Mixing one-third soybeans and two-thirds corn, and planting together rather than in separate hills, does not give uniform stands and is unsatisfactory in the Delta. Planting should b done with one operation, as two operations are expensive.

If soybeans are grown with corn and utilized for hay, planting two rows of corn in two rows of beans is probably

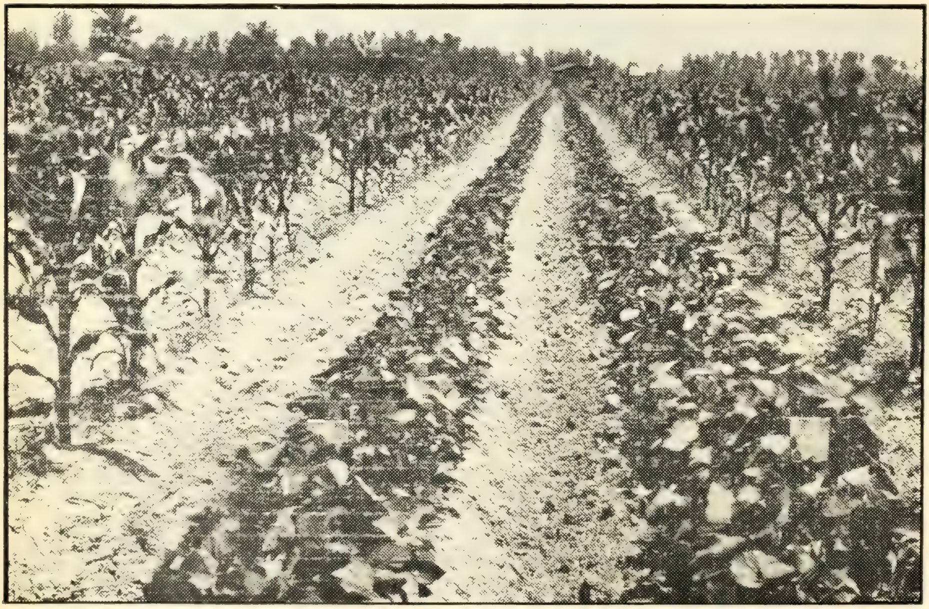


FIGURE 2—TWO ROWS SOYBEANS, TWO ROWS CORN ALTERNATING, PHOTOGRAPHED JUNE 4, 1932.

the best practice, in which event the corn and bean rows should be alternated each year. The rows should be from 36 to 40 inches apart and the corn should be left from 12 to 18 inches in drills. On the lighter soils, 200 to 250 pounds of a nitrogenous fertilizer should be applied to the corn only. It is very desirable to have a thick stand of beans.

Soybeans for Hay

Soybean hay cut at the proper stage and carefully cured is excellent for dairy cattle and yields results equal to alfafa hay. They may be planted for hay in rows and cultivated, or when the ground is free from weeds they may be drilled or broadcast. The late or medium late, viney or semi-viney, varieties are as a general rule best adapted for hay production. These varieties grow to a greater height and have more leaves and finer branches than the earlier varieties; whereas most of the seed producing beans are too woody and coarse for the best of hay unless extra thick stands are planted, in which event an abundant cheap seed supply is more important than plant type. The

TABLE 7—YIELD OF HAY IN POUNDS PER ACRE FROM SOYBEAN VARIETY TEST FOR HAY TOGETHER WITH AVERAGE PER CENT OF DRY MATTER AND RATE OF SEETING

Delta Experiment Station—1936-1938, Inclusive

Variety	Rate of Seeding Lbs. per A.	Yield of Air Dry Hay Per Acre 1936	1937	1938	3-Year Average	Average Per Cent Dry Matter
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Laredo	80	4632.0	7300.0	4879.9	5604.0	25.13
Otootan	120	6372.0	9580.0	4960.5	6970.8	29.47
Tokio	237	5784.0	7800.0	4517.0	6016.3	27.11
Pee Dee	172	7584.0	6840.0	4718.6	6380.9	27.50
Tanner	147	6794.0	4760.0	4839.6	5464.5	27.62
George Washington	244	5290.0	8300.0	3508.7	5699.6	30.54
Mamloxi	208	5142.0	7100.0	4839.6	5693.9	28.59
Mamredo	177	5464.0	....	4113.7	....	30.94
Delsta	334	6686.0	....	4275.0	....	25.75
Looney No. 2	141	5520.0	....	3508.7	....	27.85
Mamotan	171	5002.0	6640.0	....	....	33.06
Tanloxi	243	6308.0	7240.0	....	....	26.49
Ebony	108	4396.0	....	....	....	37.62
Wilson 5	124	4400.0	....	....	....	43.92
Kingwa	140	4334.0	....	....	....	44.67
Norredo	123	3502.0	....	....	....	44.20
Biloxi	326	....	6600.0	3428.1	....	24.90
Looney No. 3	294	....	6900.0	3750.7	....	24.35
Avoyelles	172	....	8380.0	4234.7	....	21.88
Delnoshat	266	....	6480.0	....	....	....

TABLE 8—SOYBEANS PLANTED BROADCAST FOR HAY

Variety	Yield in Pounds of Dry Hay 1935	1936	2-Yr. Av. 1935-36	Date Cut
Virginia	1846.7	5633.3	3590.0	August 7
Wilson	1820.0	....	1820.0	August 7
Laredo	2630.0	6200.0	4415.0	September 1
Mammoth Yellow	2728.3	6400.0	4564.2	September 1
Biloxi	6283.3	6166.7	6224.9	October 30
Otootan	3525.0	6066.7	4795.8	October 30

The pods were well filled and began to turn yellow. The Virginia and Wilson were cut August 7, Laredo and Mammoth Yellow September 1, and Biloxi and Otootan October 30. They were all too far advanced in maturity for the best quality of hay, too woody, and too much waste.

best varieties now available for hay are the Laredo, Avoyelles, and Otootan. The Laredo gives the best quality of hay and is earlier than the Avoyelles or Otootan, but either will make good growth and can be harvested for hay in August or September if planted by the 10th of May.

Table 7 shows yields of hay by a number of soybean varieties tested by the Delta Branch Experiment Station for three years, 1936-1938.

Time of Cutting Soybeans for Hay—To get the best hay from soybeans they should be cut when the pods are forming. At this stage of growth the largest yield and best quality of hay will be secured. If the cutting is done at this stage the percentage of protein will be higher and there will be practically no waste in feeding. The total yield will be higher from latter cuttings, but the quality is not so good, and the difficulty of curing is much greater. The total food constituents will be greater in the later cutting, but there will also be considerable waste of material in feeding due to the loss of leaves and the stems becoming hard and woody. W. J. Morse of the U. S. Bureau of Plant Industry states, "The soybean may be cut for hay at any time from the setting of the seed until the leaves begin to turn yellow. It is most suitable for hay, however, when the pods are well formed for at this stage of growth the largest yield and the best quality of hay will be obtained."

The factors which determine the time to cut soybeans for hay are the age and the maturity of the leaves and stems. Early cutting gives good quality of hay but smaller yields. Cutting after the seed have become well developed gives large yields but a poor quality of hay, and it is also more difficult to cure.

As a Delta hay crop, soybean yields are satisfactory and the feeding value of soybean forage is high. Soybeans should be planted for hay early enough to be harvested in the latter part of August or early September. The footnotes to table 8 reveal that even at this period the soybeans had passed the stage of optimum hay production. In addition to the harmful influence upon quality, to delay cutting until short cool days and heavy dews may make curing impracticable.

Curing Soybean Hay—The soybean should be cut after the dew is off and let lie in the swath until the next morning when it should be raked into wind-rows while damp to reduce leaf

TABLE 10—RATES OF SEEDING LAREDO, NORREDO AND MAMREDO SOYBEANS FOR HAY

Variety	Rate of Seeding (Lbs. per Acre)	Yield in Pounds per Acre		
		1934	1935	2-Year Average
Laredo*	60	3270	4720	3995
Laredo	75	4450	5310	4880
Laredo	90	5290	5680	5485
Laredo	105	5340	5970	5155
Norredo*	60	3280	4640	3960
Norredo	75	3320	5200	4260
Norredo	90	5150	5660	5405
Norredo	105	4910	5690	5300
*Cut July 25 when the Norredos were forming pods.				
Mamredo**	110		4840	
Mamredo	120		5500	
Mamredo	130		6110	
Mamredo	140		6180	
Mamredo	150		6380	
**Cut August 15 when pods were being formed.				

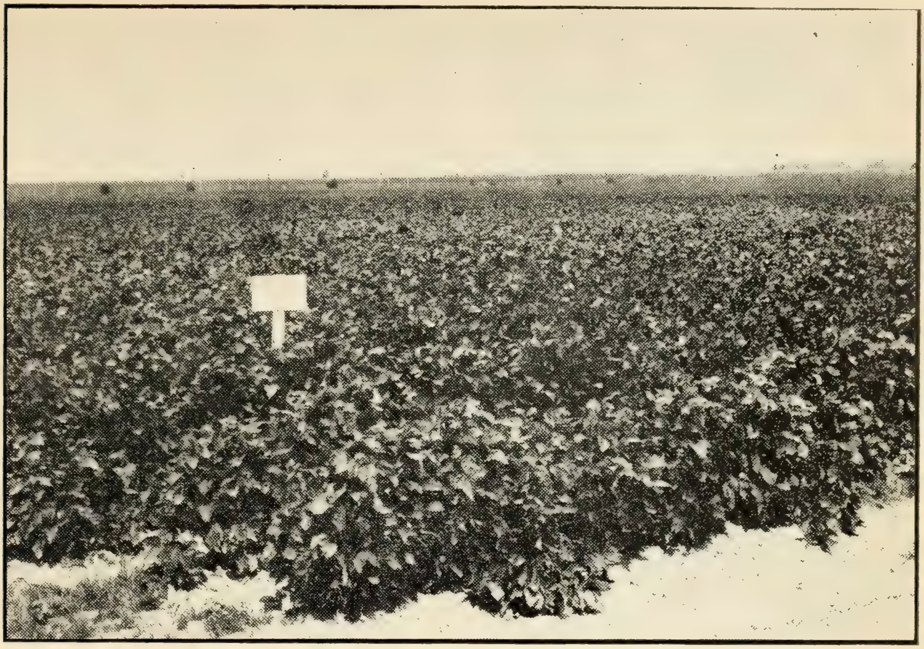


FIGURE 3—DELTA SOYBEANS FOLLOWING OATS, PHOTOGRAPHED AUGUST, 1938.

loss. However, if rained upon, the windrows may require turning several times. The cutting bar of the mower should be tilted to cut as high as possible, because a high stubble holds the hay off the ground and prevents its becoming very dusty and also allows the air to pass under it. Under ideal conditions soybean hay can be raked and put in the barn the next afternoon, unless it is very rank. Usually, however, more time is required.

Soybean hay should be thoroughly cured before being baled, housed, or stacked, as there is danger of molding when put up too green or too soon after a rain. The greatest disadvantage of soybeans as a hay crop is that usually several days are required for thorough curing.

Soybeans for Soil Improvement

Soybeans are an excellent crop to plow under for soil improvement, but not a great deal of improvement should be expected when the hay is removed and only the roots and stubbles are returned to the soil. Even though the soybean is a legume it will not increase

TABLE 6—RESIDUAL EFFECT OF OTOOTAN SOYBEANS PLANTED IN CORN

	Yields in Pound of Seed Cotton per Acre						
Plan of Planting	1927	1928	1929	1930	7-Yr. Av. 1924-30	Increase	% Increase
Corn Alone 24"	2504.3	1497.7	2121.2	914.2	1787.4	....	....
Corn 24" with Soybeans	2666.5	2394.5	2659.2	1528.8	2287.4	500.0	27.97
Corn 24", Soybeans 3 Weeks Later	2560.6	1563.7	2578.8	992.8	2048.1	260.7	14.59
Corn 24", Soybeans Alternate Rows	2842.4	2206.9	2712.8	1413.7	2321.2	533.8	29.86
Corn 12", Soybeans Alternate Rows	2631.3	2202.4	2735.5	1567.8	2266.7	479.3	26.82
Corn Alone 24"	2504.3	1497.7	2121.2	914.2	1787.4	....	....

the nitrogen content of the soil if all of the crop is removed. Investigations at the Mississippi and Ohio Agricultural Experiment Stations indicate that perhaps not more than one-fifth of the crop is left on the soil as roots and stubble. Since approximately one-third of the nitrogen used by the plant comes from the soil, it would follow that when only roots and stubble are left no more nitrogen is returned to the soil than was removed in the growth of the crop.

Where all of the crop was returned to the soil, however, as shown in table 6, the yields of seed cotton following Otootan soybeans planted in corn increased 500 pounds per acre annually for the seven-year period 1924 to 1930. It should be emphasized that these results were secured under Delta conditions, and are applicable to the Delta only.

Soybeans for Pasture

Soybeans, especially the mature and ripening pods, may be utilized to advantage in pasturing all classes of livestock which relish the bean plant. Grown alone, they may be profitably pastured by hogs to supplement the corn ration. Interplanted corn and soybeans may be grown together and

TABLE 11—YIELD AND SIZE OF SEED OF VARIETIES OF SOYBEANS

	Bushels per Acre												No. Seed
Variety	1928	1929	1930	1931	1932	1933	1934	1935	1937	1938	8-Yr. Av.	10-Yr. Av.	per Pound
Virginia	22.5	25.8	6.9	14.3	7.5	11.3	6.3	11.4	......	......	13.3	......	3455
George Washington	24.7	33.5	9.2	21.1	9.3	19.2	13.7	11.6	24.5	14.1	17.8	18.1	3200
Laredo	18.0	20.4	10.0	25.9	8.7	20.6	13.4	9.8	32.0	7.9	15.9	16.7	7775
Mamredo	26.7	36.2	11.3	21.5	12.2	27.5	14.6	14.1	21.0	9.5	20.5	19.5	3220
Mammoth Yellow	29.1	47.2	13.2	23.2	12.1	19.7	20.7	13.3	15.0	5.1	22.3	19.9	2150
Mammoth 01	27.7	51.3	11.3	21.9	20.6	25.2	19.8	13.5	......	......	23.9	......	2150
Tarheel Black	27.5	44.2	18.8	16.8	12.9	22.3	14.6	15.6	......	......	21.6	......	2710
Mamloxi	38.1	50.3	17.1	22.7	21.1	24.4	25.5	12.7	26.2	17.1	26.5	25.5	2230
Tokio	19.5	49.3	25.9	14.5	26.3	24.5	22.7	17.0	32.2	8.8	25.0	24.1	2260
Delsta	30.9	57.3	20.1	18.9	15.7	18.1	28.4	15.8	28.9	11.0	25.7	24.5	1860
Delnoshat	28..0	44.4	14.7	11.0	17.9	14.0	16.4	10.4	27.0	5.3	19.6	18.9	2340
Tanloxi	25.3	20.0	17.3	11.5	15.4	13.3	19.9	7.7	19.7	4.7	16.3	15.5	2380
Otootan	11.9	12.0	10.6	4.4	20.3	5.4	7.9	5.6	13.7	2.4	9.8	9.4	6150
Biloxi	31.4	23.0	9.0	13.8	21.7	10.5	19.0	9.6	13.9	5.8	17.3	15.8	1875
White Biloxi	......	......	......	13.1	21.6	11.7	13.2	10.6	15.0	4.6	......	......	3400
Mamotan	......	......	......	15.3	22.6	16.3	......	16.0	18.1	15.4	......	......	1900
Looney No. 1	......	......	......	18.8	10.0	24.6	20.6	18.3	......	......	......	......	3910
Looney No. 2	......	......	......	25.2	27.7	20.4	17.2	......	28.2	23.3	......	......	2880
Kingwa	......	......	......	......	......	......	14.9	13.9	17.0	20.3	......	......	3808
Looney No. 3	......	......	......	......	......	......	19.5	21.4	25.1	10.8	......	......	1860
Mammoth Brown	......	......	......	......	......	......	18.3	13.3	26.6	10.4	......	......	1855
Peking	......	......	......	......	......	......	11.1	8.3	15.0	14.9	......	......	6388
Wilson	......	......	......	......	......	......	12.2	11.4	11.6	17.4	......	......	5025
Chiquita	......	......	......	......	......	......	......	......	23.9	8.7	......	......	4050
Naking	......	......	......	......	......	......	......	......	35.7	13.8	......	......	5600
Brown Tokio	......	......	......	......	......	......	......	......	25.3	16.3	......	......	2260
Yellow Biloxi	......	......	......	......	......	......	......	......	10.0	3.8	......	......	3400
Avoyelles	......	......	......	......	......	......	......	......	18.7	4.1	......	......	3248
Pee Dee	......	......	......	......	......	......	......	......	15.8	5.8	......	......	5100
Tanner	......	......	......	......	......	......	......	......	19.3	12.1	......	......	6150
Georgian	......	......	......	......	......	......	......	......	11.2	8.4	......	......	3968
Creole	......	......	......	......	......	......	......	......	16.0	8.6	......	......	3120
Charles	......	......	......	......	......	......	......	......	23.0	7.3	......	......	3968
Monetta	......	......	......	......	......	......	......	......	15.2	10.7	......	......	2976
Palmetto	......	......	......	......	......	......	......	......	24.1	7.9	......	......	3408
Illini	......	......	......	......	......	......	......	......	8.5	6.4	......	......	2750

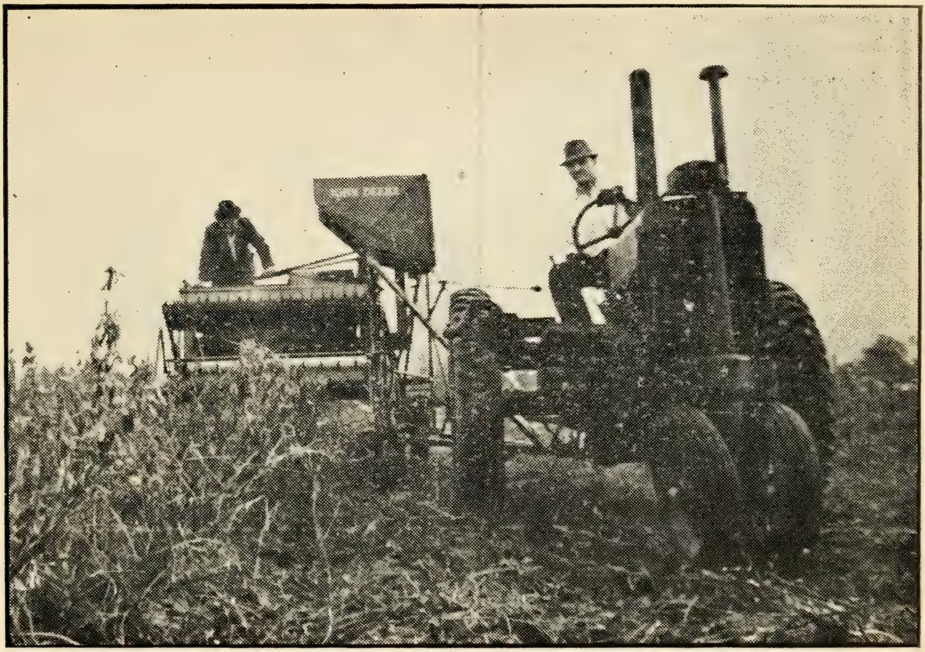


FIGURE 5—HARVESTING SOYBEANS WITH A SMALL COMBINE.

grazed in entirety, or the corn may be harvested and the beans and gleanings grazed. By planting varieties with different dates of maturity, or to some extent by planting the same variety at different dates, a continuous temporary pasture may be provided. Grain sorghum and soybeans make a good pasture, in which case the grain sorghum should be seeded somewhat thinner than when sown alone. Not only will a crop of soybeans yield a good return as a crop, but when pastured will return both the crop residue and manure, thereby to enrich the soil.

Soybeans For Grain

An extensive soybean breeding and testing program has been under way at the Delta Branch Experiment Station for several years to determine commercial soybean varieties adapted to Delta-grain production and harvesting conditions. Hundreds of varieties have been tested, some of them long established, some from other portions of the United States, others being introductions by the U. S. Department of Agriculture, and still others being new varieties developed by this and other Experiment Stations. As a result of this and the work of other breeders there are now available several high producing adaptable grain varieties, the productive capacity of which have been definitely measured.

The results of some of the testing work is shown in the following table 11 which shows the yields of grain that have been obtained from both the older varieties and the newer ones. During the ten year period of the test, the highest yields of grain were obtained from Mamloxi, Tokio, and Delsta with an average yield of 24 to 25 bushels per acre. The Mamredo and Mammoth Yellow are second in grain yield, with an average of about 19 bushels per acre.

Extremely high yields and extremely low yields noted in the table may require explanation. The velvet bean caterpillar and dry weather during the late summer were primarily responsible for the occasional low grain yields in the late maturing varieties in 1938. The high yields shown for 1929 were obtained under ideal weather conditions and the crop followed a heavy crop of bur clover which was turned under.

Harvesting Soybeans For Seed—The soybean plant reaches its ultimate size, according to variety and environment, then matures and dies. Nearly all varieties are inclined to shed their leaves at maturity, and a majority of varieties shatter their seed somewhat if allowed to stand after reaching maturity. With favorable weather conditions the leaves begin to turn yellow and drop when the soybean plant is nearing maturity. There are a few varieties that mature their pods before the leaves are all shed.

When grown for seed, the proper time to harvest is when about three-fourths of the pods are ripe, though if harvested with combine the beans should be thoroughly ripe and dry. At the three-fourths-ripe stage the beans may be cut at any time of the day with little loss by shattering. If cut earlier it is difficult to cure them properly; if not cut until very ripe the beans are liable to shatter out badly and the dry woody stems are hard to cut and thresh. When cut too early the seed may wrinkle badly during the drying period, be reduced in viability, and the hazard of molding in storage is increased. Premature cutting is done chiefly by inexperienced growers attempting to harvest both a seed and hay crop. There is no prospect of producing a crop of good hay and at the same time a good crop of seed. Either the beans are sacrificed for the hay or the hay is sacrificed for the beans, or the quality of both is greatly reduced.

Many methods of harvesting the crop are used in different sections where the soybean is grown largely for seed production. The mower, self-rake reaper, grain binder, and combine have all been used at the Delta Experiment Station for cutting soybeans, and all have proved more or less satisfactory. If the cutting is done with a mowing machine, especially when the beans are ripe, it is well to have a side-delivery attachment in order that the team and machine will not run over the swath of cut beans. When a mowing machine is used without such an attachment, the plants should be picked up behind the machine at every round to keep them out of the way of the team and the machine. If the side-delivery rake is used this will also cause some loss by shattering. The self-rake reaper with a swathing device is fairly satisfactory, the advantage of this method being that the beans are placed in bunches out of the way of the machine and the team. A grain binder can be used to good advantage for upright and taller varieties of beans. To avoid shattering when the beans are fully matured, the grain binder should be operated in the morning and evening while the beans are damp. If they are not fully matured the machine may operate any time or all time of the day. Fully matured beans cut with a grain binder can be picked up directly and hauled to a thresher. It is better to cut in the morning while they are damp and let them remain in the sunshine until afternoon and then haul to the thresher. If not fully matured, they should be placed in small shocks and allowed to remain until thoroughly dry. Not a great deal of labor is required for this process and the soybeans are more easily handled and less injured by rain when so handled.

Combines have been used most extensively for soybean harvesting in Illinois, Indiana, and other soybean producing states in the North and to some extent in the South. Soybean growers in the Delta are convinced that combining beans, where possible, saves more beans, reduces harvesting cost, and results in a higher average quality than other methods of harvesting and threshing. The combine offers the simplest and most economical method of harvestng. On a normal crop of soybeans the saving of seed alone, that usually shatter out, will amount to two to five bushels per acre. The combine does an especially clean job of harvesting, leaving the residue scattered back on the land where needed, and removing nothing from the soil except the clean seed. In the past, lack of suitable harvesting. On a normal crop of soybeans grain production in the Delta. There are now available low priced small combines which will harvest soybeans satisfactorily. They will cut, thresh, and sack with practically no cracked beans.

The Soybean As A Food

The soybean has for centuries been a chief source of protein food for hundreds of millions of people, playing a much greater role in the diet of the Chinese, Japanese, Manchurians, and Koreans than does wheat in this country. For nearly fifty centuries, the people of the Orient have been living on the products of the soybean. To these people the soybean means milk, cheese, green vegetables, eggs, meat, and condiment, and literally hundreds of millions of Orientals have never even known the taste of cow's milk. While Orientals are, for the most part, vegetarians, their diet in which the protein fraction is obtained largely from soybean products, has proved adequate to sustain life for many generations.

Though the soybean has not been, and is not now, used in the United States for food purposes to an extent approaching that in Oriental countries, it may be rightfully considered as one of the most concentrated and nutritious foods known. Unlike the cereals, which are chiefly used in the preparation of baked products, soybeans may be converted into a great variety of foods to enrich the diet or to be used as a vegetable substitute for milk, cheese, eggs, and meat. A wide range of food products have been devised from the soybean, the beans being used fresh green, dried, sprouted, parched, and fermented, while still other products include soybean oil and soybean meal. Experiments have proven that the cooked soybean has great nutritive value, is an economical source of energy, rich in calcium, phosphorus, and iron, and gives an alkaline reaction in the body.

The cooking of soybeans differs not greatly from that of other green or dried beans. Green soybeans should be boiled in the pods for three to five

TABLE 14—YIELDS OF EDIBLE VARIETIES OF SOYBEANS, 1935-1938

Variety	Acre Yield in Bushels				4 Year
	1935	1936	1937	1938	Average
Nanda	44.4	17.2	19.3	12.2	23.3
Chame	43.2	10.0	11.4	14.0	19.7
Easy Cook	20.7	4.2	16.7	4.5	11.5
Hahto	29.7	8.1	7.8	7.0	13.2
U. S. D. A. No. 84784	24.6	11.0	2.2	9.5	11.8
U. S. D. A. No. 86948-1	31.8	10.0	5.5	5.7	13.3
U. S. D. A. No. 96002	22.2	6.4	15.2	17.0	15.2
U. S. D. A. No. 87073	34.2	9.7	13.5	11.2	17.2
U. S. D. A. No. 96132	20.0	8.5	10.5	17.5	14.1
U. S. D. A. No. 82200	22.2	5.5	10.5	10.5	12.1
U. S. D. A. No. 96691	21.6	3.9	9.8	23.9	14.8

minutes, then shelled and cooked and served as other green beans. Dried soybeans, similarly, are cooked and served in the same way as other dried beans. In both instances, some varieties of soybeans require longer cooking than others, and less fat is used for seasoning because of their high fat content. Dried soybeans should always be soaked six to eight hours before cooking. After soaking, drain and add fresh water, simmer, drain and add fresh water again, then cook until they are tender.

The edible variety of soybeans are those especially desirable for human food. The Delta Branch Experiment Station has tested out some 150 of the edible soybeans varieties and among these the Nanda, Chame, and Hahto along with a number of U. S. D. A. introduction, are most promising. The following tabulation gives results of three years' work and the three-year average production of the best varieties tested.

III. Soybean Breeding by the Delta Branch Experiment Station

One of the major projects of the Delta Branch Experiment Station has been the development of better varieties and strains of soybeans adapted to Delta conditions.

The ideals kept in mind in breeding, selection, and developing better soybean varieties are: high yields, whether for grain or forage; varieties with seed of strong germinating ability; varieties adapted to different types of soil; varieties, after ready to harvest, that have the ability to retain the seed under adverse weather conditions; varieties that may be grown for different uses and that will yield more and better beans and hay, with every plant a good performer.

For crushing purposes the beans should be high in oil and yellow in color, as the trade demands yellow products; and the plant should be bushy or upright in type for the sake of ease in harvesting. For hay, the stalks and stems should be small to medium in size, with an abundance of leaves. The larger the stalks and stems, the greater the waste. For soil improvement, they should be very vigorous growers as well as good yielders.

Several of the most promising strains and varieties for the Delta were developed at the Delta Branch Experiment Station, and a brief account of their development is given here.

Delta Station Varieties

The Tanloxi, which was selected out of the Biloxi in 1924, was increased and grown rather extensively over the Delta as a hay bean, but is not grown now as they were too woody and late for the best hay, and other beans were more suited for hay purpose. It was a natural cross, thought to be Otootan crossed on Biloxi or vice versa. It is medium viney type, about midway between Otootan and Biloxi in this respect.

The Mamredo was developed from a black-banded yellow bean discovered by the author in 1924 in a quantity of Mammoth Yellow soybeans which had grown in a field adjoining a field of Laredo soybeans. The Mamredo is, therefore, presumed to be a natural hybrid between these two varieties. The Mamredo is one of the Delta's best early high producing yellow beans, as will be shown by reference to the tables which are a part of this bulletin. It makes a very good quality of hay and holds the beans well when first mature, but shatters somewhat after the beans have been ripe for some time.

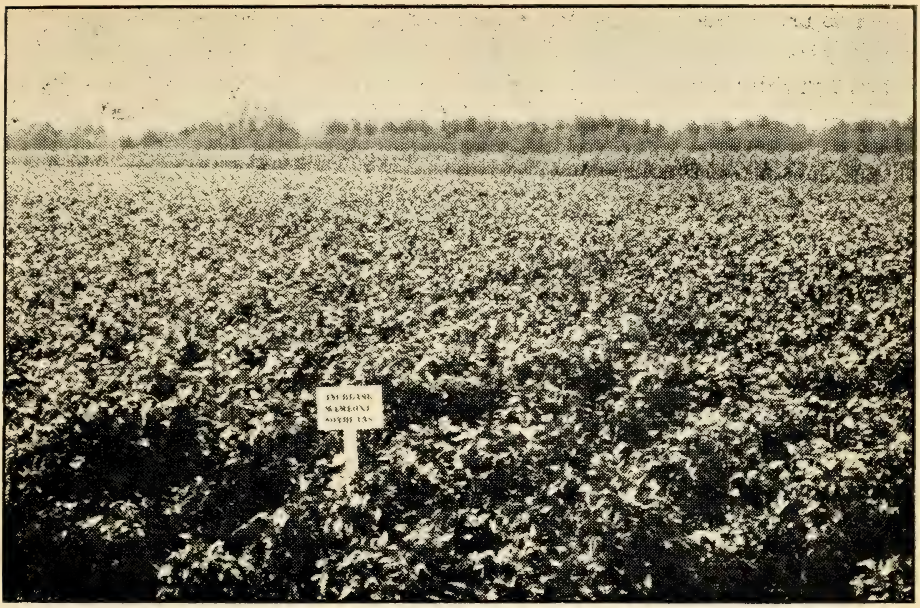


FIGURE 4—INCREASE FIELD MAMLOXI SOYBEANS, PHOTOGRAPHED AUGUST, 1938.

Mamloxi is a Mammoth Yellow-Biloxi hybrid, resulting from a cross made by the author at the Delta Branch Experiment Station in 1925. Selections have been made from its progeny for a high-yielding, non-shattering, medium-early yellow bean. The type is now well fixed, though the seeds still have some reversionary brown markings. It has the production and color qualities of the Mammoth Yellow, and the non-shattering qualities of the Biloxi, and is a combination of the plant type of both parents. It has been one of the highest yielders of grain for the past ten years and is grown extensively over the Delta.

Delsta was selected from a field of Mammoth Yellow at the Delta Branch Experiment Station in 1926. The seeds are yellow and quite large, and heavy yields of grain are secured though the plant is too coarse for good quality hay unless seeded thickly. This bean is being grown extensively over the states of Mississippi, Louisiana, Arkansas, and to some extent in Tennessee and Kentucky.

The White Biloxi is a selection from Tanloxi, which has been described in a preceding paragraph as a natural hybrid, probably Biloxi-Otootan. While not among the highest yielders at the Delta Experiment Station, it has always appeared promising for grain and soil building. It has made excellent yields at the Rice Experiment Station, Stuttgart, Arkansas.

The Mamotan is another hybrid soybean produced at the Delta Experiment Station. It is a cross between Mammoth Yellow and Otootan, upright with small stems and branches, which makes it desirable for both hay and beans, and matures about the same time as Mammoth Yellow. Though distributed a few years ago, it was withdrawn from the market for further work in fixing the desirable characters. It is not yet available commercially but is now very prolific, and the plant type and yellow seed appear to be well fixed. In the advanced increase block in 1938 it yielded 35 bushels per acre, harvested with a combine.

Individual plant selections and crosses are being made each year and the progeny selected in plant to row plots. Promising new strains are being tested and others are being increased for distribution to farmers.

IV. Soybean Varieties: Origin and Varietal Characteristics

Some of the best known varieties of soybeans grown in Mississippi are the Avoyelles, Biloxi, White Biloxi, Chiquita, Delsta, Delnoshat, George Washington, Haberlandt, Illini, Lexington, Laredo, Looney No. 3, Mammoth Yellow, Mammoth Brown, Mamredo, Mamloxi, Mamotan, Nanking, Norredo, Otootan, Peking, Virginia, and Wilson-Five.

Tests to determine the productive capacity of these and other varieties have been conducted by the Delta Branch Experiment Station over a period of ten years and more, and the results of this work (tables 4, 5, 7, 9, and 11) are the basis for the foregoing summary and the following discussion of certain varieties. Observations made during the soybean experimental work, together with current literature, is the basis of table 13, showing the origin and varietal characteristics of soybean varieties.

The **Avoyelles** soybean appears to be a sport or hybrid. It was shipped into Avoyelles Parish, Louisiana, probably from the Carolinas or Georgia, in a shipment of Otootans, and was selected from a field of Otootans and developed as a variety because of its promising appearance. It has been grown at the Delta Experiment Station for the past three years and found to be a very promising bean for this section, both for seed and hay. Seed for the test were obtained from W. T. Nolin, Hamburg, Louisiana. The beans and stems are larger and coarser than the Otootan, but fine enough for quality hay. The plant is semi-viney and seeds moderately. The seed are dull sooty black with a stippling of tan or brown, medium large, and require approximately 3,248 beans to make a pound. The pods are brown and contain from two to three seed. The hilum is black and the germ yellow. While the seed present a dull sooty black cast, they later become jet black and the tan stipples are visible upon close observation. The flowers are purple and the pubescence tawny.

Biloxi was introduced from Tangsi, China in 1908. The plants are strong, tall, erect, and bushy, and mature in about 165 days. The flowers are purple and require 85 to 90 days to bloom. The pods are two- to three-seeded and are a dark chocolate brown. the seed are large, approximately 1,875 to the pound. The hilum is pale brown, the germ yellow, and the oil content 20%. The pod formation is along the central axis, diminishing gradually toward the top. The stems are coarse and woody. Biloxi is a late maturing variety, an excellent soil builder, but not a good hay bean as it is too large, coarse, and woody. It is a fairly good seed yielder and makes an excellent growth in the Delta, sometimes attaining a height of seven feet. It is well adapted to hogging off or pasturing with livestock and for planting in corn or grain sorghum. It shatters very little in handling.

White Biloxi is a strong, tall, erect. and bushy variety somewhat like the Biloxi. The beans are yellow with approximately 2,230 to a pound. The hilum is brown, the germ yellow, and the pubescence tawny. It matures in about 165 days and requires 85 to 90 days to flower. The White Biloxi is a late variety and a very good grain bean, but is rather large, coarse, and woody for the best quality of hay, although the foliage is rather heavy. It is an excellent bean for planting in corn and grain sorghum for hogging off and pasturing with other livestock. It is a good soil builder and shatters little in handling for grain.

Chiquita was introduced from Honkow, China in 1910. The plant is semi-viney with twining terminals, matures in about 140 days along with Mammoth Yellow, with about 4,050 beans to a pound, flowers are purple and white, beans yellow, pods tawny, hilum brown. It is grown for both forage and grain, makes fairly good quality of hay, stems small to medium, foliage abundant, and medium grain yield.

Delsta is a high yielding grain bean, and medium to late in maturity. The plants are very stout, erect, and bushy, and mature in about 165 days. The flowers are white and require about 75 to 80 days to bloom. Pods are gray and two-to three-seeded. The seed are yellow, large, with about 1,860 beans to the pound. The Delsta shatters some if allowed to stand too long after fully matured. The hilum and germ are yellow. The stems are coarse and the leaves medium in size and late in maturity. It is a heavy yielder of grain but not a good hay bean. If planted thick enough it will make good quality of hay. When given space, plants grow about 3½ feet high with several branches from the central stalk approaching the height of the main axis and spreading into a broad top.

Delnoshat is stout, bushy, grows a little taller than Mammoth Yellow, and has several branches which tend to parallel the main stem. It is not as prolific as the Mammoth Yellow but shatters less. It matures extremely late, requiring 180 to 190 days to mature. The hilum is yellow, the germ creamy yellow, the pod on central axis bearing two to three seed; the flowers are purple, requiring 85 to 90 days to bloom. The beans are medium in size with about 2,340 to the pound. It produces good quality of hay if planted thick enough.

George Washington is a non-shattering selection from the Virginia variety made by Harvey S. Clapp, Accotink, Virginia, in about 1921. The plant is erect, upright, slender, with twining terminals and matures in about 150 days. The pubescence is tawny, the flowers purple, and the pods two- to three-seeded. The seed are olive brown with brown hilum, and 3,200 beans to the pound. It is more vigorous and about ten days later than the Virginia. It makes a good hay and is one of the Delta's best early hay beans.

Haberlandt was introduced from Pingyang, Korea, in 1901. The plants are stout, erect, bushy, and mature in about 130 days. The pubescence is tawny, the flowers purple and white and require 50 to 55 days to bloom. The pods are brown and two-to three-seeded.. The seed are yellow with brown hilum, and about 2,400 beans will make a pound. The germ is yellow. It is a good grain yielder and makes a good quality of hay.

Illini is a pure line selection from the A. K. variety made by the Illinois Agricultural Experiment Station. The seed are straw yellow with brown hilum and require about 2,750 beans to make a pound. The flowers are white and pods tawny. It matures hay at the Delta Experiment Station in about 75 days and seed in 95 days, but is rather small and dwarf and seeds sparsely. The stems are medium in size and the plant erect and bushy. It is the earliest maturing variety that has been grown at the Delta Station, but because of low yields the Illini is not a desirable variety in the Delta for either grain or hay.

Lexington is a selection from Sherwood in 1907. The plants are slender, erect, and mature in about 125 days. The pubescence is gray, the flowers purple and white and require 50 to 55 days to bloom; the pods are gray and two- to three-seeded. The seed are olive yellow with tawny hilum, and require approximately 3,585 beans to make a pound. The germ is yellow. This bean is not widely grown in the Delta but has possibilities as an early or medium early hay bean. The plants are medium in height and have an abundance of small stems and leaves, which make a very good quality hay.

The **Laredo** variety was introduced from Yangping, China, in 1914. The plants are slender, viney, and the stems and leaves small. It matures in about 150 days. The pubescence is tawny, flowers purple and white, requiring 75 to 80 days to bloom. The pods are two- to three-seeded. The seed are very small, black, much flattened, with black hilum and approximately 7,775 beans to the pound. The germ is yellow. The Laredo is a hay type bean, growing well on practically all soil types when properly inoculated. It is not a good bean to plant in corn unless with an early variety and planted early, otherwise the bean will ripen before the corn.

Looney No. 2 is a natural hybrid originated by C. S. Looney, Winchester, Tennessee. It is an erect bush type, slender, light foliage, medium in earliness, and requires about 145 days to mature. The seed are medium in size, with approximately 3,993 beans to a pound, and brown in color. The flowers are purple and form about 80 to 85 days after planting. It is very prolific, shatters little, and will stand much adverse weather. It makes good quality hay.

Looney No. 3 is another natural hybrid produced by C. S. Looney, Winchester, Tennessee. The plants are stout, erect, bushy, and mature in about 155 days. It will show white flowers in 85 to 90 days after planting. The pubescence is gray and the pods are gray and two- to three-seeded. The seed are yellow with black and tawny hilum. The seed are large with about 1,945 beans to a pound, and the germ is yellow. Although the foliage is heavy, it is not a good hay bean as the stems are very woody.

The origin of the **Mammoth Yellow** variety is indefinite. The plants are stout, erect, and bushy. They mature in about 150 days and flower in 80 to 90 days. Pubescence is gray, flowers white, the seed and germ are yellow with tawny hilum, and approximately 2,150 beans to make a pound. The pods are tawny and two- to three-seeded. It is a very prolific variety but shatters badly, and is not a good hay bean unless planted very thick, as the plants and stems are large and woody. It is one of the oldest varieties and is grown very extensively in the South for beans and forage.

The origin of the **Mammoth Brown** bean is obscure. The plants are stout, erect, bushy, and mature in about 150 days. The pubescence is tawny and the pods two- to three-seeded, and they shatter badly. The seed and hilum are russet and the germ yellow, with approximately 1,855 beans to the pound. This bean is too coarse for the best quality of hay. The yield for grain is about the same as Mammoth Yellow.

Mamredo is semi-erect with twining terminals, medium in size with abundant stems and leaves, and matures in about 145 days. The pubescence is tawny and the flowers both purple and white, requiring 75 to 80 days to bloom. Pods are tawny and two- to three-seeded. The seed are yellow with tan and brown hilum and the germ is yellow. Approximately 3,220 seed are required to make a pound. Mamredo is one of the Delta's best early, high producing, yellow beans.

Mamloxi, a Mammoth Yellow-Biloxi hybrid, is a high yielding, non-shattering, medium early, yellow bean. It still has some reversionary brown markings. Pods are tawny and gray and flowers are purple and white. The plant is stout, erect, and bushy. It grows taller than the Mammoth Yellow and matures seed in about the same time, 145 to 150 days. The seed are yellow and about the size of the Mammoth Yellow, probably a little larger, requiring approximately 2,330 beans to a pound. It is very prolific. The beans are well retained in the pod during adverse weather. It is too coarse and woody for the best quality of hay, unless planted very thick.

Mamotan is upright and bushy with small stems and branches which make it desirable for hay. The seed are smaller than Mammoth Yellow, with about 3,400 beans to a pound. A high yielding variety, it is also a good bean for pasturing hogs and soil building.

Nanking was introduced from China in 1927. The plants are upright, bushy, and slender. The beans are yellow and medium small, requiring aboout 3,500 to make a pound. The average height is about 37 inches. The flowers are purple and white. It is medium late in maturity.

Norredo is an unknown selection. The plant resembles the Wilson and is early, semi-viney, with about 5,856 beans to a pound. This bean has been sold in the South as Northern Laredo. It is earlier and the beans are larger than the Laredo and does not make as good a growth as the Laredo. It produces a good quality of hay but has been a low grain yielder. It is not recommended south of Memphis except for early hay. Even then the Laredo or Avoyelles is better.

Otootan was introduced from Hawaii by C. K. McClelland. It is strictly a viney variety. The seed are black and almost round, with 5,167 to a pound. Since it matures late, about November 1, early frost may damage the Otootan crop before maturity. It is one of the most popular soybeans for hay and soil building. It has leafy branches, fine stem and abundant foliage, which makes a fine quality of hay. It is a low grain producer. Otootan soybeans can be harvested for quality hay the last of September. The plants make rapid, vigorous growth in the spring, keeping down weeds and grass during the entire growing season. Otootan is one of the best varieties to plant in oats to compete with weeds and grass after the oats are harvested.

Peking is an early, semi-viney, small black seeded variety which offers some promise for early hay. The plants are slender and the stems and leaves small. The pubescence is tawny, flowers purple and white, pods tawny and well distributed along the axis, seed small, approximately 9,472 beans to the pound, seed much flattened with glossy black coat. It matures in about 125 days and requires 50 to 55 days to flower.

Virginia is a selection from Morse in 1907. It is an early medium producing bean. The plants are slender, erect, the tips inclined to twine, and matures in about 150 days. Pubescence is tawny, flowers purple, requiring 70 to 75 days to bloom; the pods tawny and two- to three-seeded, hilum olive, germ yellow, and approximately 4,430 beans to the pound. It shatters very little and produces a good yield and a good quality of hay. Planted between April 20 and 25, the hay will be ready to harvest from July 25 to August 10 in normal seasons.

Wilson-Five is a selection from Wilson in 1912. Under normal Delta conditions Wilson is a semi-viney variety. The plants are more erect, earlier, and produce much less hay than Laredo or Avoyelles. The seed are small, black, slightly flattened, oblong, and are quite easily mistaken for Laredo. This variety has no place in the Delta except for extremely early hay. It matures in about 120 days. The pubescence is gray, the flowers white, requiring 50 to 55 days to bloom, pods gray, hilum black, germ yellow, and approximately 5,719 beans required to a pound.

V. Appendix: Seed Sources; Insects, Disease, Calcium Arsenate Injury

Northern soybean seed can usually be purchased at a lower price than Southern soybeans; therefore, some seedsmen have made it a practice of shipping in Northern soybean seed of practically the same size and color as our Southern beans and selling them at a large profit. These Northern soybeans when brought South are out of their climate, environment, or adaptation; they mature earlier, are smaller in growth, and do not yield satisfactorily.

Northern Versus Southern Grown Soybeans

Southern farmers who plant Northern grown soybean seed therefore lose from the viewpoint of the price paid for the seed, the crop, and the use of the land. The loss to the farmer is in the reduced amount of seed, hay, and the smaller increase in the fertility of the land. When soybeans are brought from the North and grown in the South, the first year they are usually dwarfed and yield little, but if they are grown continuously for several years, from the seed produced in the South, they may take on more vigor and make larger growth and produce better in every way from year to year. The Lexington was grown at the Delta Experiment Station and the first year it was dwarf and early. Seed were saved each year and planted the following year, and as the bean became acclimated, it took on vigor and produced better

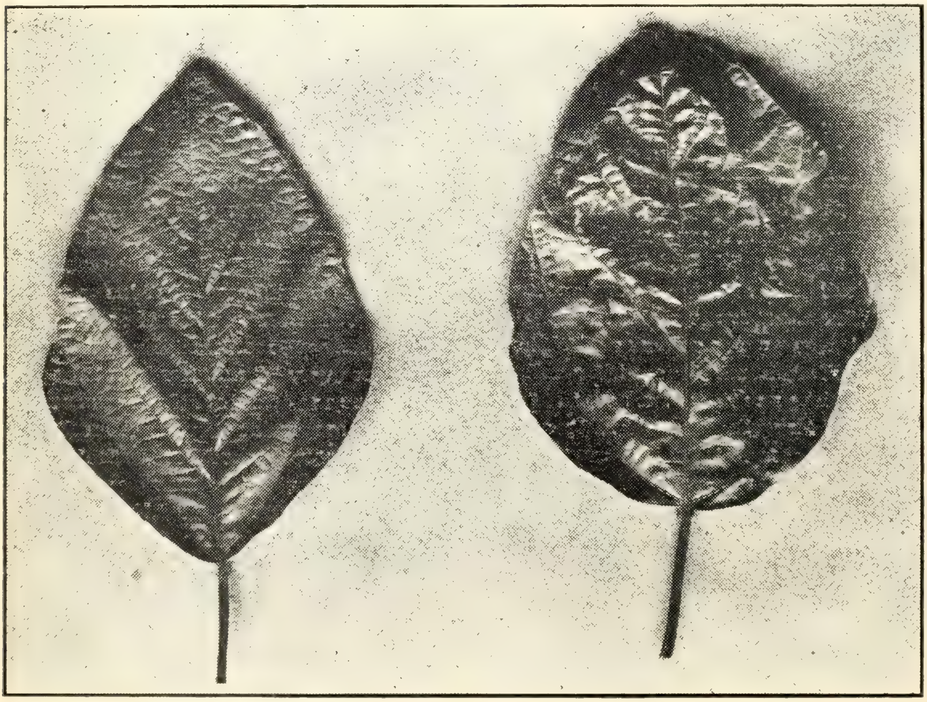


FIGURE 6—LEFT, NORMAL SOYBEAN LEAF; RIGHT, INFECTED WITH MOSAIC DISEASE.

each year. Some plants, like animals, have to become acclimated before they are at their best; meanwhile there are numerous Southern varieties already acclimated and adapted and superior in every way to the Northern varieties.

Substitution of Northern for Southern varieties of soybeans is possible because of the larger number of soybean varieties and by the close similarity in the appearance of the seeds of certain of these varieties. Sometimes the difference can be detected only by microscopic examinations.

The Laredo, for example, is a good Southern variety for hay production. Laredo seed are black in color, small in size, and very much flattened. Brown or tan stippling can be found on the seed coat of this variety when examined under a microscope. The size and shape of the seed of the Laredo variety is distinctive, but are similar in appearance with the seed of such Northern varieties as Peking, Kingwa. Noredo, and Wilson. All of these varieties may be mistaken for Laredo if examined casually, but under the microscope the brown or tan stipples are visible on the Laredo and not on the other varieties.

The Southern Otootan seed are black in color, medium to small in size, and rather round in shape. If the seed are examined under a microscope, small brown or tan stippling specks can be seen on the seed coat, as in the Laredo. The Ebony, a Northern variety, has seed very similar in shape and size to the Otootan except that it does not have these brown or tan specks, and can very easily be mistaken for Otootan without magnification. The difference in plant type and performance is that the Ebony is early, dwarf and upright or bush type, and produces quite a few seed, but shatters badly after the plant is mature. The Otootan is a strong growing, late maturing, viney variety and produces very few seed. It is one of the viniest varieties of all that have been grown at the Delta Station, and is the best late hay variety.

Soybean Disease

Mosaic, the only disease of the soybean that has been prevalent to any extent, is widely distributed in the Delta. Nevertheless, only a few areas and plants have been infected in the fields for several years, and without severe damage. The Mosaic disease is characterized by the crinkling, curling, or thickening of the leaves. The affected plants are stunted and bear very little or no fruit. The petioles and internodes are shortened to some extent. This disease is more prevalent on the Biloxi and its hybrids than on other varieties grown on the Delta Station. The young leaves were most severely affected. In some cases the entire leaf was killed by the disease. Plants infected with Mosaic remained green longer than the normal plants.

Southern Blight: There have been a few plants scattered over our soybean fields affected with this disease, but no noticeable damage has been observed in the Delta.

Calcium Arsenate Injury to Soybeans

Most Delta cotton fields are dusted with Calcium Arsenate to control the boll weevil, and where fields of soybeans are in close proximity the drifting dust settles on the soybean leaves, burning them and frequently killing the leaves, the tips, and tender pods of the plants. If the dusting takes place, as it usually does, when the soybeans are blooming or the fruit is young, the yield will be reduced or probably no fruit produced at all. Fields on the Delta Station adjoining cotton fields that were dusted for boll weevil control usually result in the soybeans being severely injured and in one instance they were completely killed. If the soybeans are near a cotton field, care should be exercised to reduce the "drift" in the direction of the beans as much as possible.

TABLE 13—SOYBEAN VARIETIES: ORIGIN AND VARIETAL CHARACTERISTICS

			Characteristics				
Variety	Origin	Year	Flower Color	Coat Color	Plant Type	Height Plant	Date of Bloom
Avoyelles	Selectios, Gray, **Louisiana	1932	p	y	Slender, viney	44"	July 21
Biloxi	Introduction, China	1908	p	cho	Slender, erect	42"	July 29
Charles	Unknown	***		y	Slender, erect	45"	June 25
Chiquita	Introduction, China	1910	p, w	y	Slender, tips inclined to twine	37"	June 28
Clemson	Unknown	***	p, w	y	Slender, erect	32"	July 8
Creole	Introduction, China	1927	p	y	Slender, erect	41"	June 25
Delnoshat	Selection, York**, Mississippi	1925	p, w	cy	Stout, erect, bushy	38"	August 6
Delsta	Selectios, York**, Mississippi	1925	w	y	Stout, erect, bushy	35"	July 27
Delsta 51035	Selection, York**, Mississippi	1935	w	y	Stout, erect bushy	32"	July 26
Delsta 51125	Selection, York**, Mississippi	1935	w	y	Stout, erect, bushy	32"	July 26
George Washington	Selection, Clapp**, Virginia	1921	p	o	Slender, erect, tips inclined to twine	42"	June 22
Georgian	Introduction, China	1927	p	y	Slender, erect	39"	June 25
Hayseed	Introduction, China	1927	w	y	Slender, erect	32"	July 8
Illini	Selection, Woodworth**, Illinois	1921	w	y	Slender, erect	25"	June 5
Kingwa	Selection, Garber**, West Virginia	1921	p	bl	Slesder, erect, tips inclined to twine	34"	June 10
Laredo	Introduction, Chisa	1914	p, w	bl	Slender, semi-viny	37"	July 15
Looney No. 2	C. S. Looney**, Winchester, Tenn.	***	p, w	br	Slender, erect	32"	July 9
Looney No. 3	C. S. Looney**, Winchester, Tenn.	***	w	y	Stout, erect	32"	July 19
Mammoth Brown	Selection, North Carolina	***	p	br	Stout, erect, bushy	37"	July 12
Mammoth Yellow	Introduction, origin unknown	***	w	y	Stout, erect, bushy	37"	July 12
Mamloxi	Cross, York**, Mississippi	1926	w	y	Slender, erect	39"	July 18
Mamloxi Gray Pod	York**, Mississippi	1925	w	y	Slender, erect, stout	43"	June 20
Mamloxi 5573	Selection, York**, Mississippi	1935	w	y	Slender, erect	36"	July 20
Mamloxi 5604	Selection, York**, Mississippi	1935	w	y	Slender, erect	36"	July 18
Mamotan	Cross, York**, Mississippi	1929	p, w	y	Slender, erect	39"	July 22
Mamoton 51391	Cross, York**, Missisippi	1935	p, w	y	Slender, erect	34"	July 18
Mamredo	Selection, York**, Missisippi	1925	p, w	y	Slender, erect, tips inclined to twine	37"	July 3
Mamredo 578	Selection, York**, Mississippi	1935	p	y	Slender, erect, tips inclined to twine	34"	July 3

*bl-black, br-brown; cho-chocolate; oy-olive yellow; p-purple. w-white; y-yellow; r-russett;; cy-creamy yellow.

**Name of breeder.

***Unknown.

TABLE 13 (CONTINUED)—SOYBEAN VARIETIES: ORIGIN AND VARIETAL CHARACTERISTICS

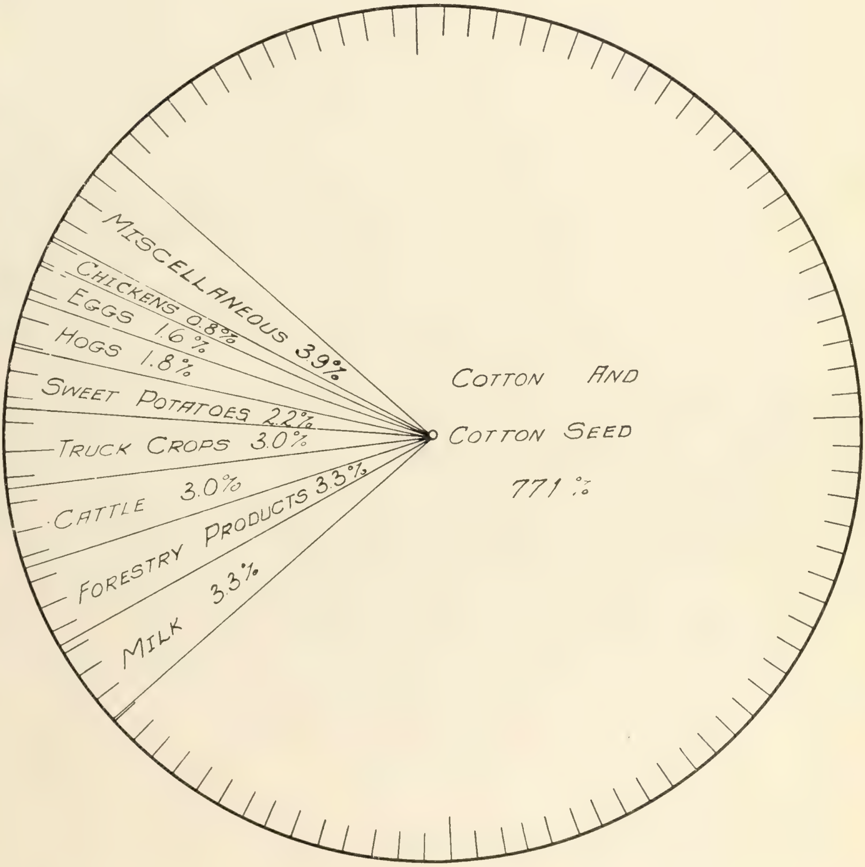
			Characteristics				
Variety	Origin	Year	Flower Color	Coat Color	Plant Type	Height Plant	Date of Bloom
Mamredo 519	Selection. York**, Mississippi	1935	p	y	Slender, erect	38"	July 3
Momredo 535	Selection, York**, Mississippi	1935	p, w	y	Slender, erect	34"	July 18
Monetta	Introduction, China	1927	p	y	Slender, erect	40"	July 1
Nanking	Introduction, China	1927	p, w	y	Slender, upright	37"	July 9
Otootan	Introduction, Taiwan	1911	p	bl	Slender, viney	41"	August 3
Palmetto	Introduction, China	1927	p	y	Slesder, erect	39"	July 5
Pee Dee	Cross, Wilds**, South Carolina	***	p	bl	Slender, viney	42"	July 23
Peking	Selection, Arlisgton Expt. Farm	1907	p, w	bl	Slender, erect	28"	June 21
Tanloxi	Selection, York**, Mississippi	1924	p	br	Slender, erect	37"	August 6
Tanloxi Yellow	Selection, York**, Mississippi	1936		y	Slender, erect	34"	July 28
Tanner	Selection, Alabama	***	p	cho	Slender, viney	40"	July 20
Tokio	Introduction, Japan	1901	p, w	oy	Stout, erect, bushy	36"	July 10
Tokio Brown	C. S. Looney**, Winchester, Tenn.	***	p, w	r	Stout, erect, bushy	36"	July 14
Unknown	Louisiana	***	p, w		Slender, erect	44"	July 19
White Biloxi	Selection, York**, Mississippi	1925	p, w	y	Slender, erect	43"	July 23
Wilson	Introduction, Manchuria	1906	p, w	bl	Slender, erect	32"	July 15
Yellow Biloxi	North Carolina	***	p, w	y	Slender, erect	41"	July 24

**Name of breeder.

***Unknown.

BULLETIN No. 332 JUNE, 1939

PRICES AND INDEX NUMBERS OF PRICES OF FARM PRODUCTS MISSISSIPPI, 1910 – 1938



Relative Importance of Various Products in the Cash Income of Mississippi Farmers

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MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
State College, Mississippi

CLARENCE DORMAN, Acting Director

PRICES AND INDEX NUMBERS OF PRICES OF FARM PRODUCTS, MISSISSIPPI, 1910-1938

MARVIN GUIN AND D. W. PARVIN

INTRODUCTION

The trend in agricultural production in Mississippi as well as in the United States has been toward specialization. Cotton and cottonseed constitute the major cash farm income in the state. Today the farmer depends largely upon the exchange value of his products. Even if Mississippi farmers become largely self-sufficient in the way of food and feed enterprises, prices will still be an important factor in motivating effort on the part of the farmer.

There has been a great deal of interest in price changes in recent years, and especially the relationships of prices of agricultural products and of non-agricultural products. Index numbers are necessary in the computation of parity prices for the state.

PURPOSE OF STUDY

The objectives of this study are: (1) To show the actual monthly prices paid Mississippi farmers (as of the fifteenth of the month) for each of twenty-three of the most important farm products for the period 1910-1938; (2) to tabulate the relative monthly prices of each of these products, and (3) to present index numbers of prices for all important farm products of Mississippi for which adequate data are available.

DEFINITIONS

It is difficult to make comparisons of price changes when one commodity is quoted in cents per pound, another in dollars per ton, and another in cents per bushel. Index numbers make possible comparisons of the price of a commodity with previous prices on a percentage basis. Index numbers of prices of farm products are useful in measuring the fluctuations in the price of particular commodities, measure changes in the price level of farm products, and provide indications of the relationship of the prices of one product or a group of products to the price of all farm products. They indicate the relationship of prices farmers pay for commodities and services to the prices of farm products and show relationship of prices of individual items to the general price level. Index numbers also indicate "parity" of prices of commodities in relation to others with a particular base.

The prices of individual commodities are fluctuating, and the general price level is always changing. For example, cotton prices may be falling while potatoes and hogs may be rising.

SOURCE OF DATA

The actual 15th of the month prices used in the construction of relatives and of the index found in this bulletin were obtained from U. S. Department of Agriculture Statistical Bulletin No. 16, "Prices of Farm Products Received by Producers" which gives the prices used from 1910 to 1925. Current issues of crops and markets of the United States Department of Agriculture were used to obtain prices of farm products since 1925. Reports entitled Farm Value, Gross Income, and Cash Income from Farm Production were used in determining the relative importance and weights given to commodities in Mississippi.

METHOD OF CONSTRUCTION

Base period.

A five year base period was chosen in preference to one year in an effort to smooth out the accidental and short-time fluctuations or to establish an average relationship among the several commodities represented in the index. It avoids excessive influence on the index numbers of unusual weather conditions in a single year or in certain months of a growing season.

The period 1924-1928 was selected as a base considered as 100 because: (1) it is recent enough to have meaning in the experience of those using price index numbers, (2) it is a fairly stable period, especially when viewed from a relative basis, (3) data are more complete and accurate since 1924 than for the period 1910 to 1914, (4) there has been a shift in the relative amount of income Mississippi farmers receive from the different farm products sold since 1914. Soybeans and lespedeza are new crops that have come into prominence since 1914. Better, and in some cases additional, statistical data are available owing to changes in farm production and other factors since 1914.

The prices shown in this bulletin are actual average prices received by Mississippi farmers for the twenty-three products listed, by months, for the period 1910 to 1938 inclusive. These are the prices reported to the state agricultural statistician and to Washington. These commodities represent the more important farm products in Mississippi for which fifteenth of the month prices of the Bureau of Agricultural Economics are available. Several important enterprises were left out because of inadequate data.

Farm prices have fluctuated greatly since 1910, some more than others. The price of cotton varied from 38.5 cents per pound in April, 1920 to 4.8 cents in June, 1932 and 8.4 in December, 1938. That is, the price of cotton was eight times higher in 1920 than in 1932. In one year, from April, 1920 to April, 1921, the price of cotton fell from 38.5 cents to 9.8 cents per pound. Cottonseed sold for $71 per ton in July, 1918, for $7.50 in October, 1931 and for $24.30 in December, 1938. Cottonseed sold for 9.5 times as much in July, 1918 as in October, 1931. Milk prices varied from $5.05 per hundred pounds in October, 1919 to $1.05 in August, 1932, and $1.85 in December, 1938. Beef cattle sold for $7.40 per hundred pounds in May, 1919, for $1.90 in December, 1932 and for $4.10 in December 1938. Sweetpotato prices varied from $2.46 per bushel in March, 1925 to 33 cents in December, 1932, and 60 cents in December, 1938. During the 29 years included in this study there were some wide fluctuations in livestock prices, but in general these prices were more stable than those of crops.

The index numbers (simple relatives) of prices for the 22 products were derived by dividing the price of the commodity, for each specified month, by the average monthly price of the commodity for the 60 months period, January, 1924 to December, 1928 and multiplying by 100. The average monthly prices during the base period, 1924-1928, for each of the 22 commodities are as follows:

Commodity	Average Price
Cotton	$0.2032 per lb.
Cottonseed	35.7388 per ton
Milk (whole)	2.6600 per 100 lbs.
Cattle	3.9350 per 100 lbs.
Sweet potatoes	1.3778 per bushel
Hogs	8.7650 per 100 lbs.
Eggs	0.2863 per dozen
Chickens	0.2119 per lb.
Potatoes	1.8855 per bushel
Hay	14.8717 per ton
Corn	1.0965 per bushel

Apples	1.7458	per bushel
Sheep	5.1400	per 100 lbs.
Lambs	7.8500	per 100 lbs.
Wool	0.3055	per lb.*
Oats	0.7092	per bushel
Butter	0.3718	per lb.
Butterfat	0.4023	per lb.
Horses	63.4333	per head
Turkeys	0.2725	per lb.**
Milk Cows	40.0800	per head
Veal Calves	5.8933	per 100 lbs.

The prosperity of a large part of Mississippi agriculture is dependent on the farm price of cotton. A decline in the index number of cotton prices from 100 for the base period 1924-1928 to 30 in 1932, 60 in 1936 and 41 in 1938 indicates how the depression has changed the income of the cotton grower. Cattle prices declined only to 61 in 1932, rose to 96 in 1936 and 108 in 1938. Milk prices declined to 47 in 1932, rose to 73 in 1936 and declined to 67 in 1938.

Relative Importance of Different Products in Farm Income

The percentage of cash farm income in Mississippi derived from each enterprise is shown in figure on front cover. This total of $214,867,000 includes cash income from all products. (1924-1928)

Cotton was by far the most important source of cash income in Mississippi accounting for 68.8 per cent of the total. Sales from cottonseed ranked second in importance, accounting for 8.4 per cent of the cash sales. Sales from milk products, which includes milk, butter, and butterfat and from forestry products amounted to 3.3 per cent each of all sales. Income from cattle and truck crops products amounted to 3 per cent each of the total sales. Sweet-potatoes constituting 2.2 per cent, hogs 1.8 per cent, and eggs 1.6 per cent of the total cash income are other important sources of cash income. A small percentage of cash income was derived from chickens, potatoes, fruit, hay, pecans, corn, sugar cane, sorghum, lespedeza seed, cowpeas, peanuts, greenhouse products, sheep, soybeans, wool, nursery products, honey and beeswax, and oats.

Composite Index of 11 Farm Products

The index numbers of individual commodity prices are indicative of the price changes by individual products. A composite index number of the leading products was calculated (Table 1) to get a general picture of how prices have affected the farm income of the state as a whole. These eleven products constitute over 91 per cent of the value of all crops and livestock products sold by farmers of the state. In this index the various products were given the relative importance indicated in the figure on front cover. Certain products, namely, forestry products, truck crops, fruits, and nuts, although important were not included because of lack of complete data. In calculating the index number the annual sales were used in determining the weights to be given to each of the eleven products as shown below:

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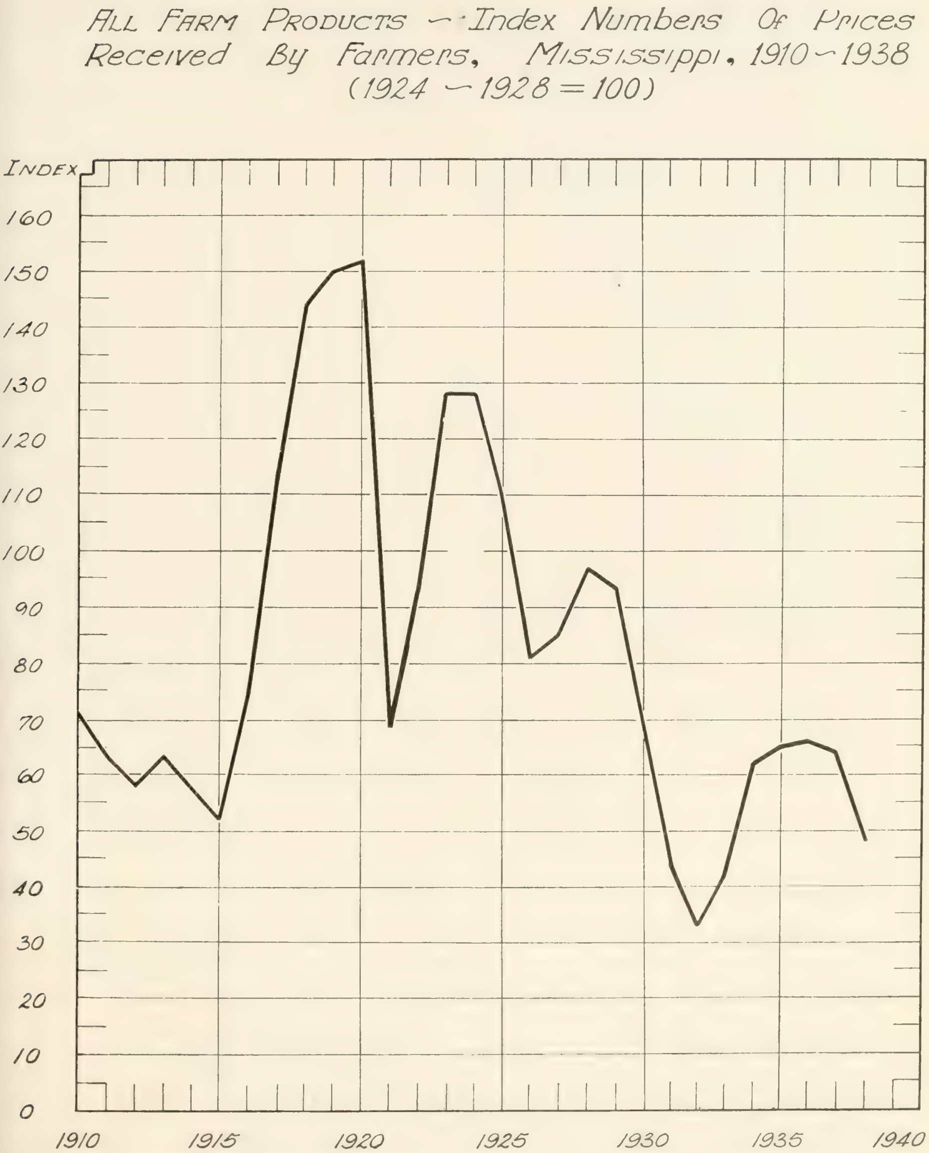
*55 months average.

**20 months average—turkey prices given for only 4 months during the year.

Commodity	Index Weight
Cotton	75.20
Cottonseed	9.14
Milk	3.64
Cattle	3.33
Sweetpotatoes	2.37
Hogs	1.98
Eggs	1.78
Chickens	.86
Potatoes	.76
Hay	.50
Corn	.44
Total	100.00

Average Prices by Months

An examination of the monthly price of the products in Table 2 enables one to gauge fairly accurately whether the price of a product will be sufficient later in the season to cover the cost of holding and shrinkage. There were no months in which cotton sold for appreciably higher prices. Hog prices are usually higher during September and October and lowest during February and June, while corn was highest during July and August and lowest in November and December. Beef cattle are usually high during May and June and low in December and January. Eggs were highest in November and December and lowest in April and May.



All Farm Products — Index Numbers Of Prices Received By Farmers, Mississippi, 1910—1938 (1924—1928 = 100)

Figure I. Mississippi farm products prices fluctuated widely and in six year cycles during the period studied.

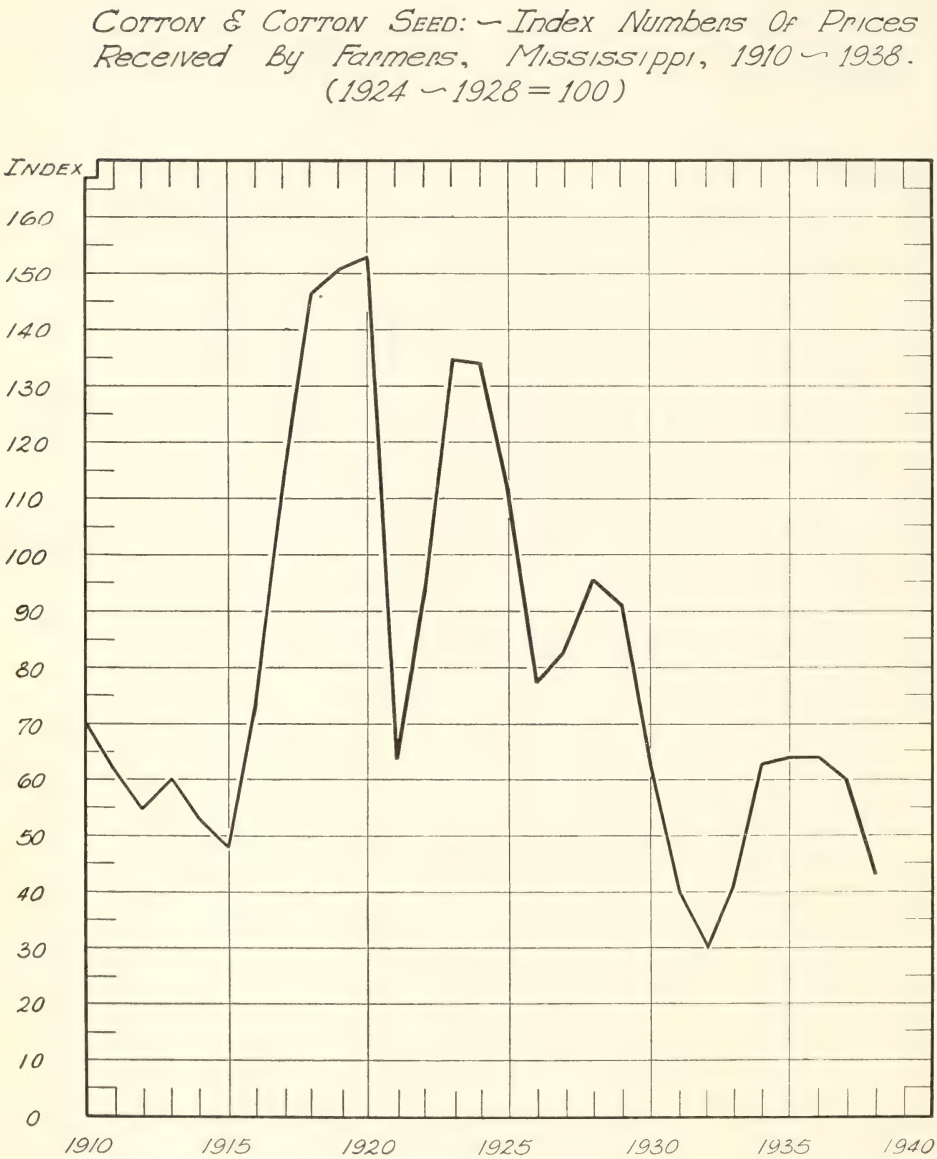


Figure II. Prices of cotton and cottonseed have run in cycles of about six years each during the period studied. They have fluctuated more than the prices of any other group of products.

TABLE 2. AVERAGE PRICES OF DESIGNATED FARM PRODUCTS BY MONTHS, MISSISSIPPI, 1910-1938

Commodity		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Cotton, lb.	c	15.9	15.8	15.7	16.0	16.2	16.2	16.5	16.2	16.4	16.3	16.1	15.8	16.1
Cottonseed, ton	$	33.30	33.81	34.20	34.97	35.70	34.71	33.86	32.39	29.95	31.55	32.62	33.24	33.36
Milk, cwt.	$	2.66	2.48	2.49	2.38	2.27	2.23	2.25	2.32	2.43	2.59	2.66	2.66	2.46
Butter, lb.	c	31.6	30.6	30.3	30.1	29.5	28.9	29.2	29.3	30.0	30.4	31.2	31.9	30.2
Butterfat*, lb.	c	34.7	34.3	34.8	34.0	30.8	29.2	29.4	29.5	30.7	31.5	32.6	34.1	32.1
Beef cattle, cwt.	$	3.85	3.94	4.06	4.18	4.33	4.20	4.11	4.03	4.00	3.98	3.86	3.81	4.03
Veal calves, cwt.	$	5.45	5.54	5.73	5.79	5.91	5.73	5.74	5.56	5.57	5.60	5.38	5.31	5.61
Sweet potatoes, bu.	$	.86	.93	1.00	1.02	1.05	1.06	1.06	1.13	1.04	.94	.79	.78	.97
Hogs, cwt.	$	7.50	7.37	7.53	7.58	7.53	7.43	7.59	7.89	8.02	8.06	7.87	7.70	7.67
Eggs, doz.	c	30.5	24.2	18.8	18.0	18.0	18.1	18.9	21.3	25.4	28.6	31.3	35.4	24.0
Chickens, lb.	c	15.4	15.7	16.0	16.8	17.6	18.1	17.4	16.3	16.8	17.1	16.5	15.9	16.6
Potatoes, bu.	$	1.42	1.57	1.70	1.68	1.59	1.41	1.32	1.35	1.36	1.34	1.37	1.35	1.45
Hay, ton	$	13.10	13.47	13.80	13.96	14.01	13.82	13.40	12.80	12.52	12.52	12.74	12.72	13.24
Corn, bu.	$	.89	.93	.97	1.01	1.06	1.08	1.11	1.10	1.03	.94	.87	.86	.99
Sheep, cwt.	$	4.47	4.74	4.74	4.76	4.94	4.68	4.74	4.52	4.56	4.57	4.42	4.38	4.63
Lambs, cwt.	$	6.26	6.75	6.80	6.64	6.88	6.83	6.87	6.53	6.40	6.46	6.33	6.28	6.56
Wool, lb.	c	25.3	23.5	23.4	23.0	23.8	24.2	24.9	25.3	24.4	24.4	23.9	24.0	24.3
Oats, bu.	$	.68	.70	.69	.68	.68	.68	.68	.67	.67	.68	.68	.67	.68
Turkeys**, lb.	c	20.9									20.5	20.7	21.6	20.8
Apples,*** bu.	$	1.25	1.29	1.35	1.29	1.20	1.17	.96	.92	.99	1.07	1.09	1.24	1.15
Milk cows, head	$	36.60	37.27	37.94	38.51	39.28	39.01	38.48	37.99	37.79	38.04	37.65	37.21	37.96
Mules, head	$	95.54	98.00	101.08	104.23	103.46	101.77	98.92	95.85	95.46	95.77	95.31	95.15	98.23
Horses, head	$	84.14	84.14	87.52	88.38	89.00	87.52	87.62	86.17	84.62	84.59	82.79	81.79	85.79

*14 year average, 1910-1914, 1930-1938.

**Prices for turkeys as released by the U. S. D. A. are quoted for only 4 months in the year.

***18 year average, 1921-1938.

TABLE 1. THE MISSISSIPPI INDEX NUMBER OF FARM PRICES (1924-1928 equals 100)

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Av.
1910	72	71	72	71	72	71	70	70	70	70	71	72	71
1911	72	70	69	69	72	71	67	62	57	52	50	50	63
1912	50	52	54	56	58	59	60	60	59	59	61	64	58
1913	64	63	62	62	61	61	61	62	64	68	66	64	63
1914	62	63	64	64	65	65	64	58	47	43	37	42	57
1915	44	45	46	49	50	49	48	48	54	64	64	65	52
1916	65	64	63	63	66	67	67	74	81	91	100	100	75
1917	93	90	91	109	106	113	121	121	118	129	140	144	114
1918	145	146	148	146	138	134	137	145	155	153	144	143	144
1919	137	128	126	130	139	148	155	157	156	171	181	177	150
1920	175	177	179	183	182	177	174	158	133	113	93	75	152
1921	70	68	59	57	59	58	58	63	81	93	86	83	69
1922	80	79	80	82	87	93	98	96	95	100	109	114	93
1923	118	125	129	129	124	118	118	116	123	133	142	150	128
1924	153	150	130	137	137	131	128	124	108	112	112	113	128
1925	112	112	118	114	111	112	111	112	112	110	95	93	110
1926	96	89	82	89	83	86	82	84	89	70	64	61	81
1927	63	68	69	71	79	80	83	84	116	107	102	97	85
1928	96	92	93	96	102	100	107	99	92	96	94	95	97
1929	95	96	98	96	95	94	92	93	95	93	87	85	93
1930	83	78	73	77	77	75	65	63	60	56	57	51	68
1931	51	52	54	54	50	45	48	38	35	33	36	35	44
1932	34	34	34	33	31	27	29	34	39	36	33	31	33
1933	31	30	32	33	42	44	52	46	46	47	49	49	42
1934	51	59	59	59	57	58	61	65	68	66	66	67	62
1935	67	68	65	65	66	65	65	63	59	62	64	64	65
1936	63	63	63	63	62	62	68	68	70	70	70	71	66
1937	71	71	74	75	72	70	69	63	54	50	48	46	64
1938	45	45	47	47	48	46	59	48	49	52	50	49	48

TABLE 3. COTTON AND COTTONSEED: INDEX NUMBERS OF PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	71*	70*	70*	70*	70*	70*	70*	70*	69	69	70	71	70
1911	71	70	69	68	72	71	67	61	54	49	46	45	62
1912	45	48	50	53	55	56	58	58	56	56	58	61	55
1913	61	61	60	60	59	59	59	59	62	65	63	60	60
1914	59	60	61	61	62	63	62	54	41	36	32	35	53
1915	37	39	40	44	45	45	43	42	50	62	62	62	48
1916	63	62	61	61	64	65	65	72	81	92	103	102	74
1917	93	88	89	99	105	113	123	123	120	132	144	148	115
1918	149	150	151	150	140	136	140	149	159	155	145	142	147
1919	137	126	124	127	137	148	157	158	157	175	187	181	151
1920	180	182	183	189	188	183	179	161	131	108	85	66	153
1921	61	60	51	49	51	52	51	57	79	92	85	81	64
1922	79	78	78	81	87	95	99	98	96	102	113	119	94
1923	124	132	138	138	131	128	125	121	130	141	152	160	135
1924	172	160	137	146	146	139	136	131	111	113	114	114	134
1925	113	113	120	117	113	115	114	114	115	112	93	91	111
1926	94	87	79	86	79	82	79	81	86	64	57	53	77
1927	56	63	65	67	76	77	79	81	119	108	102	96	83
1928	96	91	92	96	103	101	108	98	89	94	91	93	96
1929	94	95	98	95	93	92	90	91	92	90	83	81	91
1930	80	74	69	74	74	72	61	59	54	49	51	45	63
1931	46	48	50	50	50	40	45	34	30	28	32	30	40
1932	30	31	32	31	28	24	26	32	37	33	30	28	30
1933	29	28	31	31	42	44	53	45	45	46	48	49	41
1934	52	60	60	60	57	59	62	67	69	67	67	68	63
1935	68	68	65	65	67	65	65	61	57	59	62	62	64
1936	61	61	61	62	61	61	67	66	68	68	67	68	64
1937	68	69	72	74	70	68	67	58	49	43	41	39	60
1938	39	40	42	42	43	41	44	43	44	47	46	44	43

*Index for cotton only.

TABLE 4. CORN: AVERAGE PRICE PER BUSHEL RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	.86	.88	.90	.90	.92	.92	.89	.86	.79	.70	.64	.64	.83
1911	.64	.66	.67	.68	.72	.75	.78	.78	.76	.74	.72	.72	.72
1912	.74	.76	.82	.90	1.00	1.03	1.02	.96	.88	.80	.74	.72	.86
1913	.72	.73	.75	.77	.81	.82	.84	.86	.86	.84	.80	.78	.80
1914	.79	.80	.82	.82	.86	.87	.89	.92	.92	.85	.76	.74	.84
1915	.77	.80	.85	.90	.92	.94	.94	.90	.82	.71	.65	.65	.82
1916	.68	.74	.80	.84	.85	.86	.89	.92	.91	.91	.95	1.00	.86
1917	1.04	1.11	1.20	1.48	1.78	1.88	1.98	1.98	1.68	1.41	1.36	1.39	1.52
1918	1.40	1.53	1.68	1.70	1.68	1.60	1.62	1.66	1.66	1.62	1.54	1.50	1.60
1919	1.50	1.54	1.62	1.69	1.79	1.92	2.06	2.08	1.90	1.66	1.58	1.63	1.75
1920	1.71	1.82	1.93	2.06	2.22	2.32	2.33	2.16	1.80	1.36	1.07	1.02	1.82
1921	1.01	1.01	1.04	1.04	1.04	1.06	1.04	1.00	.87	.71	.60	.58	.92
1922	.62	.68	.76	.82	.87	.88	.88	.87	.83	.82	.83	.86	.81
1923	.89	.94	.98	1.01	1.04	1.06	1.08	1.08	1.03	1.05	1.08	1.00	1.02
1924	1.09	1.07	1.07	1.15	1.14	1.15	1.25	1.36	1.30	1.35	1.22	1.29	1.20
1925	1.35	1.45	1.41	1.39	1.40	1.32	1.31	1.26	1.23	1.13	.94	.93	1.26
1926	.99	.96	.93	.98	.99	.95	.96	.96	.91	.89	.82	.81	.93
1927	.81	.82	.84	.86	.89	1.01	1.07	1.08	1.11	1.01	.98	.94	.95
1928	.96	.98	1.08	1.11	1.21	1.29	1.29	1.29	1.18	1.11	1.08	1.08	1.14
1929	1.09	1.17	1.17	1.25	1.25	1.23	1.23	1.17	1.10	1.03	.97	.94	1.13
1930	.93	.96	.98	.99	1.01	1.02	1.00	1.05	1.10	1.05	1.01	.91	1.00
1931	.91	.89	.94	.96	.92	.93	.90	.81	.58	.42	.40	.40	.76
1932	.38	.38	.39	.40	.40	.41	.42	.44	.42	.41	.35	.34	.40
1933	.35	.37	.41	.48	.62	.71	.84	.85	.75	.66	.58	.59	.60
1934	.63	.68	.73	.75	.77	.82	.82	.86	.86	.85	.77	.80	.78
1935	.82	.84	.85	.88	.89	.92	.95	.94	.91	.86	.77	.74	.86
1936	.75	.76	.80	.83	.86	.88	.95	1.05	1.05	1.00	.93	.92	.90
1937	.94	.98	1.01	1.10	1.15	1.20	1.20	1.10	.99	.82	.58	.54	.97
1938	.57	.61	.65	.69	.69	.71	.73	.68	.64	.56	.49	.49	.63

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 5. CORN: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938
(1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	78	80	82	82	84	84	81	78	72	64	58	58	76
1911	58	60	61	62	66	68	71	71	69	67	66	66	66
1912	67	69	75	82	91	94	93	88	80	73	67	66	78
1913	66	67	68	70	74	75	77	78	78	77	73	71	73
1914	72	73	75	75	78	79	81	84	84	78	69	67	77
1915	70	73	78	82	84	86	86	82	75	65	59	59	75
1916	62	67	73	77	78	78	81	84	83	83	87	91	78
1917	95	101	109	135	162	171	181	181	153	129	124	127	139
1918	128	140	153	155	153	146	148	151	151	148	140	137	146
1919	137	140	148	154	163	175	188	190	173	151	144	149	160
1920	156	166	176	188	202	212	212	197	164	124	98	93	166
1921	92	92	95	95	95	97	95	91	79	65	55	53	84
1922	57	62	69	75	79	80	80	79	76	75	76	78	74
1923	81	86	89	92	95	97	98	98	94	96	98	91	93
1924	99	98	98	105	104	105	114	124	119	123	111	118	109
1925	123	132	129	127	128	120	119	115	112	103	86	85	115
1926	90	88	85	89	90	87	88	88	83	81	75	74	85
1927	74	75	77	78	81	92	98	98	101	92	89	86	87
1928	88	89	98	101	110	118	118	118	108	101	98	98	104
1929	99	107	107	114	114	112	112	107	100	94	88	86	103
1930	85	88	89	90	92	93	91	96	100	96	92	83	91
1931	83	81	86	88	84	85	82	74	53	38	36	36	69
1932	35	35	36	36	36	37	38	40	38	37	32	31	36
1933	32	34	37	44	57	65	77	78	68	60	53	54	55
1934	57	62	67	68	70	75	75	78	78	78	70	73	71
1935	75	77	78	80	81	84	87	86	83	78	70	67	78
1936	68	69	73	76	78	80	87	96	96	91	85	84	82
1937	86	89	92	100	105	109	109	100	90	75	53	49	88
1938	52	56	59	63	63	65	67	62	58	51	45	45	57

TABLE 6. OATS: AVERAGE PRICE PER BUSHEL RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	.68	.69	.68	.68	.68	.66	.66	.64	.65	.62	.56	.55	.65
1911	.58	.58	.56	.54	.52	.54	.56	.59	.60	.60	.62	.65	.58
1912	.68	.69	.69	.71	.74	.75	.72	.68	.64	.61	.60	.58	.67
1913	.58	.62	.62	.62	.61	.60	.59	.62	.63	.62	.63	.63	.61
1914	.64	.62	.61	.60	.60	.60	.61	.61	.62	.63	.64	.66	.62
1915	.65	.66	.67	.66	.66	.66	.63	.62	.62	.60	.59	.62	.64
1916	.64	.64	.64	.62	.62	.64	.60	.60	.66	.70	.73	.76	.65
1917	.79	.81	.82	.88	.94	.94	.96	.96	.94	1.01	1.02	.96	.92
1918	.96	1.01	1.10	1.13	1.12	1.06	1.04	1.10	1.14	1.10	1.08	1.06	1.08
1919	1.06	1.06	1.04	1.00	1.02	1.08	1.08	1.06	1.06	1.06	1.05	1.06	1.05
1920	1.06	1.13	1.18	1.20	1.26	1.31	1.36	1.24	1.10	1.02	.90	.81	1.13
1921	.82	.84	.74	.67	.66	.66	.65	.64	.64	.64	.63	.64	.69
1922	.66	.67	.58	.58	.62	.60	.62	.62	.60	.64	.66	.68	.63
1923	.70	.71	.72	.71	.68	.69	.69	.68	.69	.73	.76	.69	.70
1924	.69	.69	.69	.66	.64	.67	.75	.73	.80	.84	.75	.81	.73
1925	.75	.80	.80	.80	.69	.65	.69	.64	.79	.83	.78	.79	.75
1926	.74	.74	.65	.63	.60	.65	.60	.62	.62	.68	.63	.64	.65
1927	.59	.68	.63	.64	.66	.69	.67	.69	.66	.66	.70	.75	.67
1928	.70	.74	.77	.77	.78	.84	.83	.76	.66	.71	.68	.76	.75
1929	.71	.73	.71	.68	.70	.67	.68	.72	.67	.72	.72	.69	.70
1930	.72	.75	.71	.70	.67	.68	.60	.63	.67	.69	.69	.69	.68
1931	.65	.65	.59	.57	.52	.47	.44	.39	.39	.35	.40	.38	.48
1932	.34	.35	.35	.35	.32	.34	.30	.30	.31	.32	.31	.31	.33
1933	.31	.31	.32	.33	.38	.42	.57	.54	.57	.55	.56	.56	.45
1934	.55	.58	.58	.57	.57	.58	.57	.60	.67	.70	.70	.70	.61
1935	.69	.72	.72	.71	.71	.62	.60	.61	.59	.63	.60	.55	.65
1936	.55	.55	.57	.53	.47	.46	.50	.53	.60	.65	.64	.67	.56
1937	.67	.68	.69	.72	.68	.60	.60	.53	.54	.53	.50	.46	.60
1938	.49	.50	.50	.50	.48	.47	.46	.40	.42	.38	.46	.44	.46

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 7. OATS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938
(1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	96	97	96	96	96	93	93	90	92	87	79	78	92
1911	82	82	79	76	73	76	79	83	85	85	87	92	82
1912	96	97	97	100	104	106	102	96	90	86	85	82	94
1913	82	87	87	87	86	85	83	87	89	87	89	89	86
1914	90	87	86	85	85	85	86	86	87	89	90	93	87
1915	92	93	94	93	93	93	89	87	87	85	83	87	90
1916	90	90	90	87	87	90	85	85	93	99	103	107	92
1917	111	114	116	124	133	133	135	135	133	142	144	135	130
1918	135	142	155	159	158	149	147	155	161	155	152	149	152
1919	149	149	147	141	144	152	152	149	149	149	148	149	148
1920	149	159	166	169	178	185	192	175	155	144	127	114	159
1921	116	118	104	94	93	93	92	90	90	90	89	90	97
1922	93	94	82	82	87	85	87	87	85	90	93	96	89
1923	99	100	102	100	96	97	97	96	97	103	107	97	99
1924	97	97	97	93	90	94	106	103	113	118	106	114	103
1925	106	113	113	113	97	92	97	90	111	117	110	111	106
1926	104	104	92	89	85	92	85	87	87	96	89	90	92
1927	83	96	89	90	93	97	94	97	93	93	99	106	94
1928	99	104	109	109	110	118	117	107	93	100	96	107	106
1929	100	103	100	96	99	94	96	102	94	102	102	97	99
1930	102	106	100	99	94	96	85	89	94	97	97	97	96
1931	92	92	83	80	73	66	62	55	55	49	56	54	68
1932	48	49	49	49	45	48	42	42	44	45	44	44	47
1933	44	44	45	47	54	59	80	76	80	78	79	79	63
1934	78	82	82	80	80	82	80	85	94	99	99	99	86
1935	97	102	102	100	100	87	85	86	83	89	85	78	92
1936	78	78	80	75	66	65	71	75	85	92	90	94	79
1937	94	96	97	102	96	85	85	75	76	75	71	65	85
1938	69	71	71	71	68	66	65	56	59	54	65	62	65

TABLE 8. COTTON: AVERAGE PRICE PER POUND RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	14.5	14.2	14.2	14.2	14.2	14.3	14.3	14.3	13.8	13.8	14.2	14.4	14.2
1911	14.4	14.1	13.8	14.1	14.6	14.6	13.7	12.3	11.0	10.0	9.3	9.1	12.6
1912	9.2	9.8	10.2	10.8	11.2	11.2	11.8	11.8	11.4	11.4	11.8	12.4	11.1
1913	12.4	12.2	12.0	11.9	11.8	11.7	11.8	12.0	12.6	13.4	13.0	12.1	12.2
1914	11.8	12.0	12.1	12.3	12.5	12.6	12.6	10.8	8.6	7.1	6.4	6.7	10.5
1915	7.0	7.4	7.6	8.4	8.8	8.7	8.4	8.4	10.1	11.8	11.7	11.6	9.2
1916	11.8	11.6	11.4	11.2	11.8	12.4	12.4	13.8	15.8	17.6	19.6	19.2	14.1
1917	17.4	16.4	16.6	18.6	20.0	21.8	23.9	24.0	23.6	25.6	28.1	28.8	22.1
1918	29.1	29.4	29.9	29.2	27.3	26.4	27.1	29.3	31.4	30.6	28.6	28.0	28.9
1919	26.6	24.4	24.0	24.8	27.3	29.6	31.4	31.8	31.7	35.2	37.8	36.9	30.1
1920	36.6	36.9	37.4	38.5	38.0	37.2	37.0	33.3	27.8	22.8	17.6	13.7	31.4
1921	12.6	12.2	10.4	9.8	10.4	10.4	10.2	11.4	16.1	19.0	17.4	16.5	13.0
1922	16.1	15.7	15.7	15.8	17.1	19.2	20.2	20.2	20.3	21.2	23.0	24.2	19.1
1923	25.2	27.0	28.0	27.8	26.7	26.0	25.4	24.8	26.6	29.0	31.1	33.0	27.6
1924	33.9	33.1	28.0	30.0	30.0	28.7	28.0	27.0	23.0	23.3	23.4	23.4	27.7
1925	22.9	22.9	24.3	23.8	22.9	23.4	23.1	23.3	23.7	23.2	19.6	19.0	22.7
1926	19.6	18.0	16.0	17.5	15.8	16.2	15.6	16.0	17.5	13.0	11.5	10.8	15.6
1927	11.3	12.3	12.8	13.2	15.0	15.5	15.9	16.6	24.5	22.0	20.5	19.2	16.6
1928	19.0	18.0	18.2	19.2	20.4	20.0	21.8	19.6	18.0	18.6	18.0	18.2	19.1
1929	18.4	18.7	19.3	18.7	18.3	18.2	17.9	18.2	18.7	18.1	16.7	16.2	18.1
1930	16.0	14.9	13.9	14.8	14.6	14.3	12.0	11.5	10.5	9.8	10.1	8.8	12.6
1931	8.9	9.4	9.7	9.7	8.9	7.7	8.8	6.5	6.3	5.9	6.6	6.1	7.9
1932	6.1	6.3	6.5	6.2	5.7	4.8	5.3	6.6	7.5	6.8	6.1	5.6	6.1
1933	5.9	5.7	6.4	6.4	8.5	9.1	10.8	8.9	9.4	9.5	9.9	9.9	8.4
1934	10.6	12.1	12.1	12.0	11.4	11.8	12.5	13.3	13.4	12.9	12.5	12.6	12.3
1935	12.5	12.5	11.8	11.9	12.2	12.0	12.1	11.7	10.8	11.2	11.8	11.8	11.9
1936	11.4	11.5	11.5	11.5	11.4	11.6	13.0	12.6	13.1	13.0	12.8	12.9	12.2
1937	12.9	12.9	13.7	14.1	13.3	12.8	12.9	11.3	9.7	8.5	8.1	7.8	11.5
1938	7.8	7.8	8.2	8.2	8.3	7.9	8.5	8.4	8.6	9.1	8.8	8.4	8.3

TABLE 9. COTTON: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	71	70	70	70	70	70	70	70	68	68	70	71	70
1911	71	69	68	69	72	72	67	61	54	49	46	45	62
1912	45	48	50	53	55	55	58	58	56	56	58	61	55
1913	61	60	59	59	58	58	58	59	62	66	64	60	60
1914	58	59	60	61	62	62	62	53	42	35	31	33	52
1915	34	36	37	41	43	43	41	41	50	58	58	57	45
1916	58	57	56	55	58	61	61	68	78	87	96	94	69
1917	86	81	82	92	98	107	118	118	116	126	138	142	109
1918	143	145	147	144	134	130	133	144	155	151	141	138	142
1919	131	120	118	122	134	146	155	156	156	173	186	182	148
1920	180	182	184	189	187	183	182	164	137	112	87	67	155
1921	62	60	51	48	51	51	50	56	79	94	86	81	64
1922	79	77	77	78	84	94	99	99	100	104	113	119	94
1923	124	133	138	137	131	128	125	122	131	143	153	162	136
1924	167	163	138	148	148	141	138	133	113	115	115	115	136
1925	113	113	120	117	113	115	114	115	117	114	96	94	112
1926	97	89	79	86	78	80	77	79	86	64	57	53	77
1927	56	61	63	65	74	76	78	82	121	108	101	94	82
1928	94	89	90	94	100	98	107	96	89	92	89	90	94
1929	91	92	95	92	90	90	88	90	92	89	82	80	89
1930	79	73	68	73	72	70	59	57	52	48	50	43	62
1931	44	46	48	48	44	38	43	32	31	29	32	30	39
1932	30	31	32	31	28	24	26	32	37	33	30	28	30
1933	29	28	31	31	42	45	53	44	46	47	49	49	41
1934	52	60	60	59	56	58	62	65	66	63	62	62	61
1935	62	62	58	59	60	59	60	58	53	55	58	58	59
1936	56	57	57	57	56	57	64	62	64	64	63	63	60
1937	63	63	67	69	65	63	63	56	48	42	40	38	57
1938	38	38	40	40	41	39	42	41	42	45	43	41	41

TABLE 10. COTTONSEED: AVERAGE PRICE PER TON RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910									28.10	26.90	25.60	25.60	26.55*
1911	26.40	26.30	26.50	25.10	26.30	23.70	23.10	20.70	18.10	16.45	16.80	17.29	22.23
1912	17.50	17.40	19.30	18.30	21.00	21.30	20.30	20.80	18.90	19.60	21.50	22.90	19.90
1913	23.40	23.80	23.70	23.10	24.00	23.40	23.60	22.00	21.20	21.50	21.20	22.50	22.78
1914	24.00	24.10	24.30	23.40	23.40	24.30	21.50	22.50	13.00	15.80	13.60	19.30	20.77
1915	20.70	23.30	23.80	23.60	23.50	21.50	19.60	19.30	18.50	33.00	34.00	38.40	24.93
1916	37.40	37.20	36.90	38.10	39.50	35.90	35.50	38.50	39.00	47.10	56.00	58.50	41.63
1917	53.30	53.10	54.00	55.10	57.20	59.20	60.00	60.00	53.20	64.40	69.80	69.00	59.03
1918	69.50	67.70	66.70	69.90	69.10	67.00	71.00	68.00	67.50	66.10	64.10	65.50	67.68
1919	65.10	64.00	62.70	61.10	58.10	58.80	60.40	61.10	60.00	67.50	69.80	63.40	62.67
1920	63.70	64.60	63.50	66.30	70.70	65.80	55.80	49.20	28.50	26.70	26.10	21.30	50.18
1921	19.90	21.80	19.00	19.00	19.00	20.00	20.10	22.10	28.00	28.00	28.00	30.00	22.91
1922	29.30	29.60	32.20	37.50	40.00	36.10	35.50	32.00	24.00	30.00	39.00	42.00	33.93
1923	43.00	44.00	47.80	51.00	48.20	46.90	44.00	41.10	42.10	45.00	50.00	50.70	46.15
1924	48.00	48.30	45.00	44.60	45.00	45.50	43.50	39.58	32.00	34.00	37.00	39.40	41.82
1925	41.00	39.50	42.30	40.70	41.80	42.70	39.60	38.70	33.50	32.40	24.60	24.70	36.79
1926	25.80	25.70	28.90	30.85	32.20	35.90	34.40	32.90	31.50	22.20	20.40	19.80	28.38
1927	20.10	26.80	28.00	30.00	31.40	30.60	32.00	27.00	36.00	37.00	38.50	38.50	31.33
1928	39.00	39.50	40.00	41.00	46.00	44.00	42.00	41.00	33.00	38.00	40.00	41.00	40.38
1929	41.00	42.00	43.00	43.00	41.00	38.00	37.00	35.00	34.00	34.00	32.00	31.00	37.58
1930	30.00	29.00	28.00	29.00	31.00	30.00	29.00	26.00	26.00	21.00	21.00	21.00	26.75
1931	22.00	22.00	22.00	24.00	22.00	21.00	20.20	17.00	9.00	7.50	12.10	11.40	17.52
1932	10.70	10.10	10.10	9.60	10.10	9.30	9.00	10.50	13.50	12.70	11.50	10.50	10.63
1933	10.00	10.00	10.50	11.50	14.00	14.00	19.00	18.00	14.00	14.50	14.50	16.40	13.87
1934	17.50	20.00	22.50	23.50	24.00	23.00	23.00	29.00	34.00	36.00	38.00	41.00	27.63
1935	41.00	42.00	42.00	42.00	43.00	40.00	38.00	32.00	31.00	34.00	34.00	35.00	37.83
1936	35.00	35.00	35.00	36.00	35.00	32.00	33.00	34.00	36.00	36.00	36.00	38.00	35.08
1937	40.00	41.00	40.00	41.00	41.00	40.00	37.00	27.00	20.00	19.00	19.00	18.00	31.92
1938	18.00	19.00	20.00	21.00	22.00	22.00	21.00	22.00	23.00	24.00	24.80	24.30	21.76

*Four months average.

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 11. COTTONSEED: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910									79	75	72	72	74
1911	74	74	74	70	74	66	65	58	51	46	47	48	62
1912	49	49	54	51	59	60	57	58	53	55	60	64	56
1913	65	66	66	65	67	65	66	62	59	60	59	63	64
1914	67	67	68	65	65	68	60	63	36	44	38	54	58
1915	58	65	67	66	66	60	55	54	52	92	95	107	70
1916	105	104	103	107	111	100	99	108	109	132	157	164	116
1917	149	149	151	154	160	166	168	168	149	180	195	193	165
1918	194	189	187	196	193	187	199	190	189	185	179	183	189
1919	182	179	175	171	163	165	169	171	168	189	195	177	175
1920	178	181	178	186	198	184	156	138	80	75	73	60	140
1921	56	61	53	53	53	56	56	62	78	78	78	84	64
1922	82	83	90	105	112	101	99	90	67	84	109	118	95
1923	120	123	134	143	135	131	123	115	118	126	140	142	129
1924	134	135	126	125	126	127	122	111	90	95	104	110	117
1925	115	111	118	114	117	119	111	108	94	91	69	69	103
1926	72	72	81	86	90	100	96	92	88	62	57	55	79
1927	56	75	78	84	88	86	90	76	101	104	108	108	88
1928	109	111	112	115	129	123	118	115	92	106	112	115	113
1929	115	118	120	120	115	106	104	98	95	95	90	87	105
1930	84	81	78	81	87	84	81	73	73	59	59	59	75
1931	62	62	62	67	62	59	57	48	25	21	34	32	49
1932	30	28	28	27	28	26	25	29	38	36	32	29	30
1933	28	28	29	32	39	39	53	50	39	41	41	46	39
1934	49	56	63	66	67	64	64	81	95	101	106	115	77
1935	115	118	118	118	120	112	106	90	87	95	95	98	106
1936	98	98	98	101	98	90	92	95	101	101	101	106	98
1937	112	115	112	115	115	112	104	76	56	53	53	50	89
1938	50	53	56	59	62	62	59	62	64	67	69	68	61

TABLE 12. APPLES: AVERAGE PRICE PER BUSHEL RECEIVED BY FARMERS MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	1.25	1.45	1.75	.50	.81	1.12	.93	1.11	.99	1.02	1.00	1.50	1.12
1911	1.25	1.30	1.08	.92	1.00	.95	1.00	.83	.99	1.40	1.10	1.33	1.10
1912	1.25	1.10	1.30	1.30	.85	1.50	.95	.87	.91	.86	1.00	1.13	1.09
1913	1.00	1.00	1.25	1.25	1.00	.93	1.00	.98	1.00	1.00	1.00	1.25	1.06
1914	1.00	1.00	1.00	1.20	1.25	1.05	1.00	.93*	.85	.90	.90	1.00	1.01
1915	1.00	1.00	1.00*	1.00*	1.00*	1.00	.91	.86	.86	.90	1.05	1.05	.96
1916	1.05	......	......	......	......	1.00	.93	.95	.90	1.05	1.00	1.00	.99[1]
1917	1.40	1.70*	2.00	......	......	......	......	.95	1.00	1.00	1.40	1.35	1.30[1]
1918	2.50	......	......	......	......	1.10	1.05	1.05	1.50	1.50	1.80	1.90*	1.50[1]
1919	2.00	1.00	......	......	......	..	......	1.50	1.70	2.10	2.50	2.00	1.83[2]
1920	2.50*	3.00*	3.50	3.20*	2.80*	2.40*	2.10	1.70	1.93	1.94	2.38	2.45	2.29[3]
1921	2.24	......	......	......	......	......	......	......	......	2.28	......	......	2.26[4]
1922	......	......	......	......	......	......	1.28	1.25	1.50	1.50	1.75	1.85	1.52
1923	2.10	2.25	2.00	2.00*	2.05*	2.10*	2.10	1.50	1.75	1.56	1.50	1.60	1.82
1924	1.70	1.80	2.00	2.00	2.20	2.00	1.70	1.74	1.20	1.80	1.60	1.67	1.78
1925	1.70*	1.70*	1.73	2.38	3.50	1.50	1.46	1.26	1.72	1.64	1.95	1.50	1.55
1926	2.00	2.25*	2.50*	2.75*	3.00	1.60	1.30	1.20	1.30	1.20	1.05	1.50	1.57
1927	1.50	1.70	1.60*	1.50*	1.40*	1.30	1.20	1.25	1.30	1.75	1.75	1.85	1.51
1928	1.90	2.00	2.15*	2.30*	2.45*	2.60	1.15	1.20	1.15	1.40	1.60	1.65	1.63
1929	1.60	1.40	1.60	1.60*	1.65*	1.65	1.25	1.20	1.15	1.45	1.50	1.55	1.44
1930	1.55	1.50	1.50	1.50	1.40	1.30	1.10	1.20	1.20	1.20	1.10	1.35	1.33
1931	1.35	1.50	1.60	1.60	1.35	1.10	.90	.65	.65	.70	.80	.85	1.09
1932	.85	1.00	1.05	1.00	1.10	.85	.60	.75	.80	1.00	1.15	1.25	.95
1933	1.10	1.10	1.20	1.40	1.15	1.20	.90	.75	.95	1.00	1.20	1.20	1.10
1934	1.25	1.50	1.50	1.70	1.50	1.50	1.00	.85	.95	1.25	1.45	1.45	1.33
1935	1.45	1.60	1.65	1.75	1.50	1.10	1.05	1.00	1.20	1.25	1.15	1.25	1.33
1936	1.35	1.35	1.40	1.35	1.30	1.40	1.10	1.10	1.25	1.30	1.35	1.45	1.31
1937	1.70	1.60	1.50	1.50	1.50	1.30	1.00	1.00	1.00	1.05	1.00	1.05	1.27
1938	1.10	1.00	1.10	1.10	1.15	1.10	.95	.90	1.05	1.00	1.10	1.25	1.07

*Interpolated.

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

[1] 8 month averages.

[2] 7 month averages.

[3] 2 months average.

[4] 6 months average.

TABLE 13. APPLES: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	72	83	100	29	46	64	53	64	57	58	57	86	64
1911	72	74	62	53	57	54	57	48	57	80	63	76	63
1912	72	63	74	74	49	86	54	50	52	49	57	65	62
1913	57	57	72	72	57	53	57	56	57	57	57	72	61
1914	57	57	57	69	72	60	57	53	49	52	52	57	58
1915	57	57	57	57	57	57	52	49	49	52	60	60	55
1916	60	......	......	......	......	57	53	54	52	60	57	57	57
1917	80	97	115	......	......	......	......	54	57	57	80	77	74
1918	143	......	......	......	......	63	60	60	86	86	103	109	86
1919	115	57	......	......	......	......	......	86	97	120	143	115	105
1920	143	172	200	183	160	137	120	97	111	111	136	140	131
1921	128	......	......	......	......	......	......	......	......	131	......	......	129
1922	......	......	......	......	......	......	73	72	86	86	100	106	87
1923	120	129	115	115	117	120	120	86	100	89	86	92	104
1924	97	103	115	115	126	115	97	100	69	103	92	96	102
1925	97	97	99	136	200	86	84	72	99	94	112	86	89
1926	115	129	143	158	172	92	74	69	74	69	60	86	90
1927	86	97	92	86	80	74	69	72	74	100	100	106	86
1928	109	115	123	132	140	149	66	69	66	80	92	95	93
1929	92	80	92	92	95	95	72	69	66	83	86	89	82
1930	89	86	86	86	80	74	63	69	69	69	63	77	76
1931	77	86	92	92	77	63	52	37	37	40	46	49	62
1932	49	57	60	57	63	49	34	43	46	57	66	72	54
1933	63	63	69	80	66	69	52	43	54	57	69	69	63
1934	72	86	86	97	86	86	57	49	54	72	83	83	76
1935	83	92	95	100	86	63	60	57	69	72	66	72	76
1936	77	77	80	77	74	80	63	63	72	74	77	83	75
1937	97	92	86	86	86	74	57	57	57	60	57	60	73
1938	63	57	63	63	66	63	54	52	60	57	63	72	61

TABLE 14. MILK, WHOLE: WHOLESALE PRICE PER 100 POUNDS RECEIVED BY FARMERS, MISSISSIPPI, BY MONTHS, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	2.40	2.35	2.35	2.15	1.95	1.90	1.95	2.00	2.10	2.20	2.30	2.40	2.17
1911	2.40	2.35	2.20	2.00	1.85	1.85	1.85	1.95	2.05	2.20	2.30	2.45	2.12
1912	2.55	2.55	2.55	2.25	2.10	2.05	2.05	2.10	2.15	2.25	2.45	2.55	2.30
1913	2.50	2.40	2.35	2.30	2.15	2.10	2.15	2.25	2.25	2.35	2.45	2.50	2.31
1914	2.50	2.40	2.35	2.30	2.20	2.15	2.15	2.25	2.30	2.35	2.50	2.55	2.33
1915	2.60	2.50	2.30	2.20	2.10	2.00	2.05	2.25	2.40	2.45	2.55	2.50	2.33
1916	2.30	2.25	2.15	2.10	2.05	2.00	2.00	2.05	2.20	2.30	2.40	2.40	2.18
1917	2.50	2.40	2.35	2.30	2.25	2.25	2.25	2.35	2.45	2.60	3.00	3.25	2.50
1918	3.30	3.20	3.15	3.10	3.00	2.90	2.90	2.95	3.25	4.00	4.10	4.15	3.33
1919	4.30	4.25	4.20	4.15	4.10	4.10	4.15	4.25	4.40	5.05	5.05	5.05	4.42
1920	5.05	5.00	4.90	4.80	4.15	4.05	4.05	4.20	4.80	4.90	4.90	4.10	4.58
1921	4.15	4.05	3.65	3.60	3.55	3.35	3.30	3.30	3.35	3.35	2.95	2.95	3.46
1922	3.00	2.90	2.85	2.80	2.75	2.75	2.80	2.80	2.85	2.90	2.95	2.95	2.86
1923	3.00	2.90	2.85	2.80	2.75	2.70	2.75	2.80	2.90	3.15	3.20	3.20	2.92
1924	3.25	3.15	3.10	3.05	2.80	2.65	2.70	2.80	2.85	2.90	2.90	2.85	2.92
1925	2.75	2.70	2.55	2.45	2.20	2.10	2.20	2.30	2.60	2.75	2.80	2.85	2.52
1926	2.85	2.70	2.60	2.50	2.45	2.35	2.45	2.55	2.60	2.75	2.80	2.85	2.62
1927	2.90	2.75	2.60	2.55	2.45	2.45	2.45	2.45	2.55	2.70	2.80	2.85	2.63
1928	2.80	2.65	2.55	2.45	2.40	2.35	2.40	2.45	2.65	2.80	2.95	2.95	2.62
1929	2.75	2.75	2.65	2.50	2.45	2.40	2.40	2.45	2.60	2.80	2.80	2.70	2.60
1930	2.65	2.50	2.40	2.25	2.20	2.15	2.15	2.20	2.35	2.50	2.50	2.35	2.35
1931	2.10	1.95	1.85	1.70	1.55	1.55	1.50	1.50	1.55	1.75	1.75	1.75	1.69
1932	1.60	1.50	1.35	1.20	1.15	1.15	1.05	1.05	1.10	1.25	1.30	1.30	1.25
1933	1.25	1.15	1.10	1.10	1.15	1.20	1.30	1.40	1.40	1.50	1.60	1.50	1.30
1934	1.40	1.50	1.50	1.35	1.35	1.40	1.40	1.55	1.60	1.70	1.90	1.95	1.55
1935	1.95	1.90	1.85	1.70	1.50	1.60	1.65	1.75	1.75	1.80	1.80	1.90	1.77
1936	1.95	2.00	1.95	1.75	1.65	1.65	1.75	1.95	2.00	2.10	2.15	2.20	1.93
1937	2.20	2.15	2.10	1.90	1.85	1.80	1.80	1.85	1.95	2.15	2.25	2.25	2.02
1938	2.15	2.05	1.85	1.75	1.65	1.65	1.60	1.60	1.60	1.65	1.80	1.85	1.77

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 15. MILK, WHOLE: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	90	88	88	81	73	71	73	75	79	83	86	90	82
1911	90	88	83	75	70	70	70	73	77	83	86	92	80
1912	96	96	96	85	79	77	77	79	81	85	92	96	86
1913	94	90	88	86	81	79	81	85	85	88	92	94	87
1914	94	90	88	86	83	81	81	85	86	88	94	96	88
1915	98	94	86	83	79	75	77	85	90	92	96	94	88
1916	86	85	81	79	77	75	75	77	83	86	90	90	82
1917	94	90	88	86	85	85	85	88	92	98	113	122	94
1918	124	120	118	117	113	109	109	111	122	150	154	156	125
1919	162	160	158	156	154	154	156	160	165	190	190	190	166
1920	190	188	184	180	156	152	152	158	180	184	184	154	172
1921	156	152	137	135	133	126	124	124	126	126	111	111	130
1922	113	109	107	105	103	103	105	105	107	109	111	111	108
1923	113	109	107	105	103	102	103	105	109	118	120	120	110
1924	122	117	117	115	105	100	102	105	107	109	109	107	110
1925	103	102	96	92	83	79	83	86	98	103	105	107	95
1926	107	102	98	94	92	88	92	96	98	103	105	107	98
1927	109	103	98	96	92	92	92	92	96	102	105	107	99
1928	105	100	96	92	90	88	90	92	100	105	111	111	98
1929	103	103	100	94	92	90	90	92	98	105	105	102	98
1930	100	94	90	85	83	81	81	83	88	94	94	88	88
1931	79	73	70	64	58	58	56	56	58	66	66	66	64
1932	60	56	51	45	43	43	39	39	41	47	49	49	47
1933	47	43	41	41	43	45	49	53	53	56	60	56	49
1934	53	56	56	51	51	53	53	58	60	64	71	73	58
1935	73	71	70	64	60	60	62	66	66	68	68	71	67
1936	73	75	73	66	62	62	66	73	75	79	81	83	73
1937	83	81	79	71	70	68	68	70	73	81	85	85	76
1938	81	77	70	66	62	62	60	60	60	62	68	70	67

TABLE 16. BUTTER: AVERAGE PRICE PER POUND RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	24	23	22	22	22	21	22	22	22	22	23	24	22
1911	24	23	22	22	21	21	21	21	22	22	22	23	22
1912	23	22	22	22	22	22	22	22	22	22	22	24	22
1913	24	23	22	22	22	22	22	22	22	23	24	24	23
1914	24	24	24	24	22	23	24	22	22	23	23	24	23
1915	24	22	22	22	23	23	22	22	22	22	23	24	23
1916	24	24	24	24	23	23	24	24	24	24	26	28	24
1917	28	28	28	29	30	29	29	28	30	32	34	36	30
1918	36	36	36	34	34	33	32	34	36	38	40	42	36
1919	44	40	38	38	38	39	40	40	41	44	48	50	42
1920	50	46	46	48	47	44	45	46	44	44	46	47	46
1921	44	38	37	36	34	30	32	33	33	34	35	36	35
1922	35	33	34	33	32	32	32	32	32	33	35	37	33
1923	36	36	36	36	34	34	34	34	36	37	38	42	36
1924	40	41	41	41	38	35	35	35	39	38	36	33	38
1925	38	38	36	37	37	36	37	37	38	35	38	38	37
1926	39	38	39	38	37	36	35	36	35	36	38	39	37
1927	39	38	38	36	33	36	35	36	36	37	37	38	37
1928	37	37	36	37	37	36	35	36	39	39	41	39	37
1929	39	38	39	38	39	37	38	38	38	38	38	38	38
1930	36	36	36	35	35	33	34	34	36	35	35	34	35
1931	30	29	29	29	27	26	26	25	25	27	27	26	27
1932	26	23	21	21	22	20	21	20	20	20	20	20	21
1933	20	19	19	19	20	21	22	20	21	22	21	21	20
1934	21	22	23	23	22	22	22	23	25	25	25	26	23
1935	27	28	28	28	26	26	25	26	26	26	27	28	27
1936	27	27	26	26	26	26	27	27	28	28	29	29	27
1937	29	28	28	28	28	27	28	29	29	29	29	29	28
1938	28	28	27	26	25	25	25	25	26	26	26	26	26

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 17. BUTTER: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	65	62	59	59	59	56	59	59	59	59	62	65	59
1911	65	62	59	59	56	56	56	56	59	59	59	62	59
1912	62	59	59	59	59	59	59	59	59	59	59	65	59
1913	65	62	59	59	59	59	59	59	59	62	65	65	62
1914	65	65	65	65	59	62	65	59	59	62	62	65	62
1915	65	59	59	59	62	62	59	59	59	59	62	65	62
1916	65	65	65	65	62	62	65	65	65	65	70	75	65
1917	75	75	75	78	81	78	78	75	81	86	91	97	81
1918	97	97	97	91	91	89	86	91	97	102	108	113	97
1919	118	108	102	102	102	105	108	108	110	118	129	134	113
1920	134	124	124	129	126	118	121	124	118	118	124	126	124
1921	118	102	100	97	91	81	86	89	89	91	94	97	94
1922	94	89	91	89	86	86	86	86	86	89	94	100	89
1923	97	97	97	97	91	91	91	91	97	100	102	113	97
1924	108	110	110	110	102	94	94	94	105	102	97	89	102
1925	102	102	97	100	100	97	100	100	102	94	102	102	100
1926	105	102	105	102	100	97	94	97	94	97	102	105	100
1927	105	102	102	97	89	97	94	97	97	100	100	102	100
1928	100	100	97	100	100	97	94	97	105	105	110	105	100
1929	105	102	105	102	105	100	102	102	102	102	102	102	102
1930	97	97	97	94	94	89	91	91	97	94	94	91	94
1931	81	78	78	78	73	70	70	67	67	73	73	70	73
1932	70	62	56	56	59	54	56	54	54	54	54	54	56
1933	54	51	51	51	54	56	59	54	56	59	56	56	54
1934	56	59	62	62	59	59	59	62	67	67	67	70	62
1935	73	75	75	75	70	70	67	70	70	70	73	75	73
1936	73	73	70	70	70	70	73	73	75	75	78	78	73
1937	78	75	75	75	75	73	75	78	78	78	78	78	75
1938	75	75	73	70	67	67	67	67	70	70	70	70	70

TABLE 18. BUTTERFAT: AVERAGE PRICE PER POUND RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1920									59	60	56	56	58*
1921	54	48	52	47	30	26	30	36	35	34	38	38	39
1922	37	36	34	33	32	32	32	31	33	36	40	45	35
1923	47	49	51	53	42	38	37	36	39	41	48	52	44
1924	54	50	50	45	40	37	38	33	35	35	37	40	41
1925	36	36	40	38	37	37	39	32	40	40	42	43	38
1926	40	41	42	39	38	36	36	37	36	36	38	41	38
1927	46	45	46	44	41	36	36	34	36	40	40	44	41
1928	42	43	44	43	41	41	40	42	42	44	44	46	43
1929	43	44	44	44	43	42	41	39	41	41	40	37	42
1930	35	34	32	35	35	30	29	31	34	34	31	28	32
1931	23	23	25	26	18	18	19	20	22	25	24	22	22
1932	19	16	16	14	13	12	11	14	14	14	15	16	15
1933	15	14	13	14	16	17	19	16	16	16	16	16	16
1934	14	18	20	19	19	19	19	21	21	21	22	24	20
1935	25	29	28	29	27	23	20	22	22	24	25	30	25
1936	30	31	29	29	27	26	29	32	33	32	32	32	30
1937	32	32	32	32	30	30	30	31	30	31	31	33	31
1938	32	29	29	28	26	25	24	24	23	23	24	26	26

*Four months average.

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 19. BUTTERFAT: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1920									147	149	139	139	144
1921	134	119	129	117	75	65	75	89	87	85	94	94	97
1922	92	89	85	82	80	80	80	77	82	89	99	112	87
1923	117	122	127	132	104	94	92	89	97	102	119	129	109
1924	134	124	124	112	99	92	94	82	87	87	92	99	102
1925	89	89	99	94	92	92	97	80	99	99	104	107	94
1926	99	102	104	97	94	89	89	92	89	89	94	102	94
1927	114	112	114	109	102	89	89	85	89	99	99	109	102
1928	104	107	109	107	102	102	99	104	104	109	109	114	107
1929	107	109	109	109	107	104	102	97	102	102	99	92	104
1930	87	85	80	87	87	75	72	77	85	85	77	70	80
1931	57	57	62	65	45	45	47	50	55	62	60	55	55
1932	47	40	40	35	32	30	27	35	35	35	37	40	37
1933	37	35	32	35	40	42	47	40	40	40	40	40	40
1934	35	45	50	47	47	47	47	52	52	52	55	60	50
1935	62	72	70	72	67	57	50	55	55	60	62	75	62
1936	75	77	72	72	67	65	72	80	82	80	80	80	75
1937	80	80	80	80	75	75	75	77	75	77	77	82	77
1938	80	72	72	70	65	62	60	60	57	57	60	65	65

TABLE 20. CHICKENS: AVERAGE PRICE PER POUND RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	11.4	11.8	11.4	11.6	11.8	11.8	11.6	11.6	11.6	12.0	12.5	12.2	11.8
1911	11.4	11.4	11.4	11.1	11.6	12.0	11.8	11.6	11.7	11.4	11.1	11.8	11.5
1912	11.8	11.2	11.2	11.0	11.2	11.4	11.4	11.4	11.8	12.0	11.9	11.7	11.5
1913	11.6	11.5	11.6	11.8	12.1	12.5	12.8	13.2	13.6	14.5	13.2	12.2	12.6
1914	12.3	12.4	12.5	13.2	13.0	13.5	13.9	12.8	12.5	12.4	12.2	11.3	12.7
1915	11.3	11.9	12.0	11.4	12.0	12.8	12.4	11.7	12.2	12.5	11.8	11.6	12.0
1916	10.6	11.3	11.3	12.4	13.5	14.5	12.6	12.5	13.1	14.0	13.6	12.5	12.7
1917	13.2	13.7	14.0	16.0	15.7	17.2	15.8	15.6	16.5	18.0	17.5	18.4	16.0
1918	17.8	19.3	18.5	20.0	19.8	21.5	23.0	21.5	22.7	21.3	21.9	20.9	20.7
1919	20.9	20.0	22.0	24.0	25.0	27.5	27.5	24.0	25.0	25.0	24.0	24.0	24.1
1920	24.0	24.5	25.7	26.0	27.9	28.2	30.4	27.8	28.0	27.0	25.0	21.0	26.3
1921	19.8	21.0	21.0	21.0	22.0	23.0	21.0	20.0	20.0	21.0	21.0	21.0	21.0
1922	18.0	18.0	19.0	20.4	21.8	23.0	21.0	18.0	20.0	19.0	19.0	18.0	19.6
1923	17.7	18.1	18.0	18.0	20.6	22.0	21.0	19.0	19.0	21.0	19.5	18.0	19.3
1924	17.6	19.1	19.0	21.0	21.0	22.6	21.0	19.3	19.8	21.0	18.1	18.7	19.9
1925	19.8	19.6	20.5	20.8	25.0	25.1	21.5	21.2	22.0	22.8	22.0	20.4	21.7
1926	20.9	20.9	21.3	23.6	24.9	25.5	23.8	21.8	21.7	21.6	21.2	20.8	22.3
1927	20.1	20.7	21.6	23.6	23.5	22.5	20.3	20.1	20.3	20.8	20.7	19.5	21.1
1928	18.5	19.5	19.6	20.0	22.0	22.9	22.7	21.1	21.7	21.7	21.2	19.9	20.9
1929	20.6	20.6	21.4	22.6	24.0	24.1	23.4	22.0	21.9	23.0	21.3	20.8	22.1
1930	19.8	20.4	20.3	21.0	20.1	20.4	18.3	17.7	17.9	18.2	17.5	16.0	19.0
1931	14.4	15.0	15.1	16.0	17.0	16.3	15.1	14.4	13.8	14.2	14.3	13.8	15.0
1932	11.7	11.7	11.4	12.3	12.5	11.7	10.7	9.8	10.0	10.0	9.4	8.6	10.8
1933	8.3	8.3	7.9	8.8	9.8	10.5	10.3	8.9	9.0	9.8	9.6	9.2	9.2
1934	9.3	9.7	10.2	10.5	11.1	11.6	11.9	10.9	12.0	12.0	12.0	11.7	11.1
1935	11.5	12.0	12.8	13.8	14.3	15.0	13.5	13.0	14.0	14.4	14.7	14.2	13.6
1936	14.3	14.6	14.8	15.0	15.8	15.8	15.6	14.5	14.8	14.9	14.6	13.9	14.9
1937	12.8	13.0	13.7	14.4	14.8	15.7	15.7	14.6	15.6	15.8	15.0	14.4	14.6
1938	13.8	14.1	14.4	14.9	15.6	15.3	14.3	13.8	14.0	14.5	14.0	13.6	14.4

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 21. CHICKENS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	54	56	54	55	56	56	55	55	55	57	59	58	56
1911	54	54	54	52	55	57	56	55	55	54	52	56	54
1912	56	53	53	52	53	54	54	54	56	57	56	55	54
1913	55	54	55	56	57	59	60	62	64	68	62	58	59
1914	58	59	59	62	61	64	66	60	59	59	58	53	60
1915	53	56	57	54	57	60	59	55	58	59	56	55	57
1916	50	53	53	59	64	68	59	59	62	66	64	59	60
1917	62	65	66	76	74	81	75	74	78	85	83	87	76
1918	84	91	87	94	93	101	109	101	107	101	103	99	98
1919	99	94	104	113	118	130	130	113	118	118	113	113	114
1920	113	116	121	123	132	133	143	131	132	127	118	99	124
1921	93	99	99	99	104	109	99	94	94	99	99	99	99
1922	85	85	90	96	103	109	99	85	94	90	90	85	92
1923	84	85	85	85	97	104	99	90	90	99	92	85	91
1924	83	90	90	99	99	107	99	91	93	99	85	88	94
1925	93	92	97	98	118	118	101	100	104	108	104	96	102
1926	99	99	101	111	118	120	112	103	102	102	100	98	105
1927	95	98	102	111	111	106	96	95	96	98	98	92	100
1928	87	92	92	94	104	108	107	100	102	102	100	94	99
1929	97	97	101	107	113	114	110	104	103	109	101	98	104
1930	93	96	96	99	95	96	86	84	84	86	83	76	90
1931	68	71	71	76	80	77	71	68	65	67	67	65	71
1932	55	55	54	58	59	55	50	46	47	47	44	41	51
1933	39	39	37	42	46	50	49	42	42	46	45	43	43
1934	44	46	48	50	52	55	56	51	57	57	57	55	52
1935	54	57	60	65	67	71	64	61	66	68	69	67	64
1936	67	69	70	71	75	75	74	68	70	70	69	66	70
1937	60	61	65	68	70	74	74	69	74	75	71	68	69
1938	65	67	68	70	74	72	67	65	66	68	66	64	68

TABLE 22. TURKEYS: AVERAGE PRICE PER HEAD RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Oct. 15	Nov. 15	Dec. 15	Year
1912		13.4	13.0	13.6	13.3
1913	13.4	13.2	14.1	14.0	13.7
1914	14.3	14.6	13.8	12.8	13.9
1915	12.7	13.4	13.2	13.4	13.2
1916	13.0	15.5	16.5	17.5	15.6
1917	17.4	19.7	21.4	22.9	20.4
1918	21.8	23.3	23.0	25.6	23.4
1919	25.2	26.0	27.0	32.0	27.6
1920	32.0	33.0	30.0	28.0	30.8
1921	28.2	24.0	22.0	30.0	26.1
1922	28.0	25.0	27.0	29.0	27.3
1923	27.8	28.0	28.0	24.0	27.0
1924	23.0	27.0	23.9	22.0	24.0
1925	25.4	27.7	26.3	28.2	26.9
1926	30.3	26.5	28.7	29.0	28.6
1927	29.0	26.0	28.0	29.0	28.0
1928	29.0	27.0	29.0	30.0	28.8
1929	28.0	31.0	29.0	26.0	28.5
1930	25.0	22.0	21.0	19.0	21.8
1931	19.0	16.0	17.0	18.0	17.5
1932	17.0	12.0	13.0	11.0	13.3
1933	9.0	11.0	12.0	11.0	10.8
1934	11.0	13.0	13.8	15.0	13.2
1935	15.0	15.0	18.0	19.0	16.8
1936	18.0	17.0	17.0	17.0	17.3
1937	15.0	17.0	18.0	17.0	16.8
1938	17.0	15.0	16.0	17.0	16.3

Data Compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 23. TURKEYS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1912-1938 (1924-1928 equals 100)

Year	Jan. 15	Oct. 15	Nov. 15	Dec. 15	Year
1912		49	48	50	49
1913	49	48	52	51	50
1914	52	54	51	47	51
1915	47	49	48	49	48
1916	48	57	61	64	57
1917	64	72	79	84	75
1918	80	86	84	94	86
1919	92	95	99	117	101
1920	117	121	110	103	113
1921	103	88	81	110	96
1922	103	92	99	106	100
1923	102	103	103	88	99
1924	84	99	88	81	88
1925	93	102	97	103	99
1926	111	97	105	106	105
1927	106	95	103	106	103
1928	106	99	106	110	106
1929	103	114	106	95	105
1930	92	81	77	70	80
1931	70	59	62	66	64
1932	62	44	48	40	49
1933	33	40	44	40	39
1934	40	48	51	55	48
1935	55	55	66	70	62
1936	66	62	62	62	63
1937	55	62	66	62	62
1938	62	55	59	62	60

TABLE 24. EGGS: AVERAGE PRICE PER DOZEN RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	26.0	23.0	19.0	16.0	16.0	17.0	16.0	18.0	20.0	21.0	22.0	24.0	19.8
1911	24.0	18.0	16.0	15.0	14.0	14.0	14.0	16.0	18.0	20.0	21.0	23.0	17.8
1912	24.0	21.0	18.0	16.0	15.0	16.0	16.0	16.0	18.0	20.0	22.0	24.0	18.8
1913	22.0	19.0	16.0	15.0	14.0	15.0	14.0	14.0	19.0	22.0	26.0	29.0	18.8
1914	24.0	20.0	17.0	14.0	14.0	14.0	14.0	16.0	19.0	20.0	22.0	27.0	18.4
1915	25.0	19.0	14.0	14.0	13.0	13.0	13.0	15.0	17.0	21.0	23.0	26.0	17.8
1916	22.0	20.0	15.0	14.0	15.0	15.0	15.0	18.0	21.0	25.0	28.0	35.0	20.3
1917	32.0	31.0	21.0	24.0	25.0	27.0	22.0	25.0	30.0	33.0	37.0	41.0	29.0
1918	42.0	38.0	25.0	28.0	26.0	24.0	26.0	28.0	33.0	40.0	45.0	52.0	33.9
1919	48.0	30.0	28.0	31.0	32.0	31.0	32.0	35.0	40.0	45.0	49.0	60.0	38.4
1920	55.0	45.0	35.0	32.0	31.0	31.0	32.0	38.0	44.0	48.0	52.0	62.0	42.1
1921	48.0	26.0	22.0	18.0	17.0	17.0	20.0	23.0	26.0	29.0	38.0	40.0	27.0
1922	30.0	27.0	16.0	17.0	17.0	17.0	18.0	23.0	25.0	30.0	35.0	39.0	24.3
1923	32.0	26.0	21.0	17.0	20.0	20.0	22.0	24.0	28.0	32.0	36.0	44.0	26.8
1924	37.0	34.0	34.0	19.0	19.0	20.0	22.0	24.0	32.0	36.0	41.0	44.0	30.2
1925	45.0	36.0	21.0	22.0	21.0	22.0	22.0	26.0	30.0	35.0	39.0	46.0	30.4
1926	34.0	29.0	20.0	22.0	24.0	21.0	22.0	24.0	31.0	32.0	36.0	44.0	28.3
1927	34.0	25.0	18.0	18.0	17.0	17.0	20.0	23.0	29.0	35.0	37.0	38.0	25.9
1928	37.0	25.0	20.0	20.0	20.0	21.0	24.0	26.0	32.0	36.0	39.0	41.0	28.4
1929	35.0	28.0	25.0	21.0	23.0	23.0	25.0	27.0	33.0	37.0	39.0	42.0	29.8
1930	38.0	30.0	19.0	21.0	20.0	18.0	19.0	22.0	26.0	27.0	27.0	30.0	24.8
1931	23.0	15.0	14.5	15.2	12.8	14.4	13.7	16.0	18.8	19.8	20.9	22.2	17.2
1932	17.3	10.1	8.7	9.3	8.7	10.0	9.6	12.0	15.2	18.4	21.4	22.7	13.6
1933	20.6	9.3	8.0	8.0	9.6	8.7	11.7	14.0	16.6	19.0	19.0	22.0	13.9
1934	17.0	17.0	11.6	11.6	11.9	12.7	13.1	15.4	20.0	23.0	23.8	27.4	17.0
1935	23.0	23.0	15.0	17.0	17.5	17.6	17.5	19.0	25.0	26.1	26.4	30.0	21.4
1936	25.0	22.0	14.6	15.5	16.1	16.8	18.6	22.0	25.2	27.3	29.0	34.5	22.2
1937	24.8	20.2	17.8	18.0	16.6	17.0	18.8	21.2	23.2	26.6	27.6	28.7	21.7
1938	21.0	15.6	14.0	14.1	15.0	15.6	16.7	18.9	22.8	24.3	25.7	28.6	19.4

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 25. EGGS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	91	80	66	56	56	59	56	63	70	73	77	84	69
1911	84	63	56	52	49	49	49	56	63	70	73	80	62
1912	84	73	63	56	52	56	56	56	63	70	77	84	66
1913	77	66	56	52	49	52	49	49	66	77	91	101	66
1914	84	70	59	49	49	49	49	56	66	70	77	94	64
1915	87	66	49	49	45	45	45	52	59	73	80	91	62
1916	77	70	52	49	52	52	52	63	73	87	98	122	71
1917	112	108	73	84	87	94	77	87	105	115	129	143	101
1918	147	133	87	98	91	84	91	98	115	140	157	182	118
1919	168	105	98	108	112	108	112	122	140	157	171	210	134
1920	192	157	122	112	108	108	112	133	154	168	182	217	147
1921	168	91	77	63	59	59	70	80	91	101	133	140	94
1922	105	94	56	59	59	59	63	70	87	105	122	136	85
1923	112	91	73	59	70	70	77	84	98	112	126	154	94
1924	129	119	119	66	66	70	77	84	112	126	143	154	105
1925	157	126	73	77	73	77	77	91	105	122	136	161	106
1926	119	101	70	77	84	73	77	84	108	112	126	154	99
1927	119	87	63	63	59	59	70	80	101	122	129	133	90
1928	129	87	70	70	70	73	84	91	112	126	136	143	99
1929	122	98	87	73	80	80	87	94	115	129	136	147	104
1930	133	105	66	73	70	63	66	77	91	94	94	105	87
1931	80	52	51	53	45	50	48	56	66	69	73	78	60
1932	60	35	30	32	30	35	34	42	53	64	75	79	48
1933	72	32	28	28	34	30	41	49	58	66	66	77	49
1934	59	59	41	41	42	44	46	54	70	80	83	96	59
1935	80	80	52	59	61	61	61	66	87	91	92	105	75
1936	87	77	51	54	56	59	65	77	88	95	101	121	78
1937	87	71	62	63	58	59	66	74	81	93	96	100	76
1938	73	54	49	49	52	54	58	66	80	85	90	100	68

TABLE 26. BEEF CATTLE: AVERAGE PRICE PER 100 POUNDS RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	3.20	3.50	4.00	3.90	4.30	3.80	3.10	3.40	3.10	3.20	3.30	3.10	3.49
1911	3.40	3.40	3.60	3.20	3.50	3.20	3.20	3.10	3.10	3.20	3.10	2.90	3.24
1912	3.20	3.10	3.00	3.20	3.50	3.50	3.40	3.40	3.50	3.30	3.20	3.20	3.29
1913	3.50	3.30	3.60	3.80	4.00	3.90	4.00	4.00	4.10	4.40	4.20	4.00	3.90
1914	4.00	4.10	4.20	4.40	4.60	4.60	4.50	4.50	4.50	4.50	4.30	4.00	4.35
1915	4.10	4.20	4.20	4.20	4.30	4.20	5.00	4.20	4.00	4.00	3.90	3.80	4.18
1916	3.90	3.80	4.30	4.30	4.60	4.50	4.80	4.60	4.50	4.40	4.30	4.50	4.38
1917	4.70	5.10	5.50	6.00	6.30	6.30	5.90	5.80	6.10	6.00	5.80	6.10	5.80
1918	6.30	6.20	6.40	6.80	7.30	7.30	7.10	6.90	7.00	6.70	6.30	6.60	6.74
1919	6.60	6.60	6.50	7.00	7.40	7.10	7.20	6.90	6.50	6.00	5.90	5.90	6.63
1920	6.00	6.20	6.60	6.30	6.30	6.20	5.80	5.50	5.20	5.00	4.60	4.00	5.64
1921	3.60	3.80	3.90	4.10	3.80	3.10	3.40	3.20	3.20	3.10	3.10	2.90	3.43
1922	2.80	3.00	3.30	3.30	3.30	3.20	3.00	3.00	3.00	3.00	3.00	3.00	3.08
1923	3.00	3.00	3.10	3.10	3.00	3.10	3.10	3.10	2.90	2.90	2.40	2.90	2.97
1924	3.10	3.00	3.00	3.00	3.00	2.90	2.80	2.80	2.70	2.70	2.70	2.70	2.87
1925	3.00	3.50	3.20	3.10	3.60	3.10	2.90	3.10	3.20	3.10	3.50	3.30	3.22
1926	3.50	3.50	3.50	3.90	3.90	4.10	3.90	4.00	3.90	4.20	3.70	3.80	3.83
1927	3.90	4.00	3.90	4.10	4.40	4.20	4.30	4.20	4.50	4.60	4.70	4.80	4.30
1928	4.70	5.30	5.10	5.40	5.60	5.60	5.70	5.50	5.80	5.90	5.70	5.30	5.47
1929	5.50	5.40	5.60	5.90	6.20	6.60	5.90	6.30	5.90	6.30	6.00	5.80	5.90
1930	5.70	5.70	5.70	5.80	5.70	5.50	4.10	3.80	3.80	3.70	3.70	3.50	4.73
1931	3.30	3.50	3.80	3.70	3.70	3.60	3.30	3.00	2.80	2.80	2.70	2.70	3.24
1932	2.80	2.60	2.70	2.60	2.60	2.30	2.40	2.40	2.20	2.20	1.95	1.90	2.39
1933	1.90	1.95	2.05	2.15	2.35	2.30	2.30	2.25	2.10	2.05	2.00	2.00	2.12
1934	1.95	2.20	2.20	2.40	2.40	2.30	2.15	2.05	2.40	2.40	2.25	2.25	2.25
1935	2.45	2.85	2.95	3.10	3.25	3.40	3.25	3.10	3.45	3.40	3.50	3.35	3.17
1936	3.50	3.60	3.65	3.80	3.90	3.85	3.75	3.75	3.85	3.75	3.90	3.90	3.77
1937	3.90	3.90	4.20	4.35	4.35	4.40	4.45	4.50	4.40	4.30	4.15	4.10	4.25
1938	4.10	4.00	4.10	4.40	4.30	4.25	4.40	4.40	4.40	4.40	4.20	4.10	4.25

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 27. BEEF CATTLE: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	81	89	102	99	109	97	79	86	79	81	84	79	89
1911	86	86	91	81	89	81	81	79	79	81	79	74	82
1912	81	79	76	81	89	89	86	86	89	84	81	81	84
1913	89	84	91	97	102	99	102	102	104	112	107	102	99
1914	102	104	107	112	117	117	114	114	114	114	109	102	111
1915	104	107	107	107	109	107	127	107	102	102	99	97	106
1916	99	97	109	109	117	114	122	117	114	112	109	114	111
1917	119	130	127	152	160	160	150	147	155	152	147	155	147
1918	160	158	163	173	186	186	180	175	178	170	160	168	171
1919	168	168	165	178	188	180	183	175	165	152	150	150	168
1920	152	158	168	160	160	158	147	140	132	127	117	102	143
1921	91	97	99	104	97	79	86	81	81	79	79	74	87
1922	71	76	84	84	84	81	76	76	76	76	76	76	78
1923	76	76	79	79	76	79	79	79	74	74	61	74	75
1924	79	76	76	76	76	74	71	71	69	69	69	69	73
1925	76	89	81	79	91	79	74	79	81	79	89	84	82
1926	89	89	89	99	99	104	99	102	99	107	94	97	97
1927	99	102	99	104	112	107	109	107	114	117	119	122	109
1928	119	135	130	137	142	142	145	140	147	150	145	135	139
1929	140	137	142	150	158	168	150	160	150	160	152	147	150
1930	145	145	145	147	145	140	104	97	97	94	94	89	120
1931	84	89	97	94	94	91	84	76	71	71	69	69	82
1932	71	66	69	66	66	58	61	61	56	56	50	48	61
1933	48	50	52	55	60	58	58	57	53	52	51	51	54
1934	50	56	56	61	61	58	55	52	61	61	57	57	57
1935	62	72	75	79	83	86	83	79	88	86	89	85	81
1936	89	91	93	97	99	98	95	95	98	95	99	99	96
1937	99	99	107	111	111	112	113	114	112	109	105	104	108
1938	104	102	104	112	109	108	112	112	112	112	107	104	108

TABLE 28. VEAL CALVES: AVERAGE PRICE PER 100 POUNDS RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	4.10	4.80	4.20	4.30	4.50	4.50	4.30	4.50	4.10	4.30	4.40	3.80	4.32
1911	4.50	5.05*	5.60	4.50	4.10	3.60	3.60	4.10	4.20	3.60	3.80	3.60	4.19
1912	4.00	3.90	5.00	3.90	4.00	4.80	4.90	4.30	5.00	4.60	4.50	4.70	4.47
1913	4.80	4.70	4.40	4.80	5.20	4.40	4.80	5.20	5.30	5.40	4.80	5.30	4.93
1914	5.20	5.30	5.80	5.50	5.90	5.90	5.90	5.70	5.60	5.80	5.40	5.30	5.61
1915	5.30	5.00	5.30	5.70	5.60	5.50	6.10	5.10	5.10	5.30	5.20	5.20	5.37
1916	5.20	5.00	5.40	5.60	6.10	5.90	6.10	6.10	5.80	5.80	5.80	6.00	5.73
1917	6.50	6.70	7.10	7.60	8.40	7.70	7.90	7.00	7.20	7.80	7.90	7.80	7.47
1918	7.70	8.20	8.50	8.70	9.90	9.30	9.70	8.70	8.90	9.20	8.10	8.50	8.78
1919	9.00	9.20	8.30	8.90	9.10	9.00	9.50	8.90	8.40	8.30	7.90	8.60	8.76
1920	8.40	8.70	9.90	9.00	9.10	8.60	8.20	8.00	7.10	7.90	6.50	6.10	8.13
1921	5.70	5.70	5.90	5.90	5.70	5.00	4.70	4.70	4.70	4.70	4.70	4.70	5.18
1922	4.50	4.40	4.90	5.60	5.00	4.50	4.40	4.00	4.50	4.70	4.50	4.50	4.63
1923	4.30	4.90	4.90	5.00	4.70	4.50	5.10	4.60	4.20	4.70	4.20	3.80	4.58
1924	4.90	4.60	4.60	4.70	4.50	4.40	4.80	4.40	4.50	4.00	4.50	4.20	4.51
1925	4.80	5.00	4.80	5.10	5.80	4.10	4.90	5.20	5.30	5.50	5.30	5.20	5.08
1926	5.00	5.50	5.80	5.90	5.70	5.70	5.70	6.00	5.60	6.50	5.40	5.60	5.70
1927	5.70	6.10	6.40	6.40	6.10	6.90	6.00	6.10	6.90	6.40	6.70	6.40	6.34
1928	7.30	7.00	7.40	7.70	7.80	8.20	8.00	8.30	8.70	7.90	7.90	7.80	7.83
1929	7.70	7.90	8.20	8.20	8.60	8.80	8.60	8.60	8.80	8.50	8.20	7.50	8.30
1930	8.10	7.70	7.00	7.40	7.60	7.50	5.50	5.20	5.20	5.50	5.10	4.80	6.38
1931	5.40	5.20	5.30	5.50	5.30	4.90	5.60	4.60	4.00	4.20	4.30	3.80	4.84
1932	4.30	4.00	4.10	3.90	3.90	3.50	3.50	3.70	3.25	3.30	3.00	2.75	3.60
1933	2.85	3.00	3.05	3.15	3.45	3.50	3.40	3.40	3.15	3.00	3.00	3.00	3.16
1934	3.10	3.20	3.20	3.40	3.30	3.30	3.15	3.10	3.50	3.50	3.35	3.35	3.29
1935	3.55	3.90	4.35	4.50	4.55	4.65	4.50	4.40	4.70	4.70	4.70	4.80	4.44
1936	4.95	5.10	5.10	5.30	5.20	5.40	5.40	5.30	5.30	5.20	5.20	5.40	5.24
1937	5.40	5.40	5.90	5.80	6.10	5.90	6.00	6.10	6.20	6.00	5.80	5.70	5.86
1938	5.70	5.60	5.90	6.10	6.10	6.10	6.10	6.00	6.30	6.10	5.80	5.80	5.97

*Interpolated.

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 29. VEAL CALVES: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	70	81	71	73	76	76	73	76	70	73	75	64	73
1911	76	86	95	76	70	61	61	70	71	61	64	64	71
1912	68	66	85	66	68	81	83	73	85	78	76	80	76
1913	81	80	75	81	88	75	81	88	90	92	81	90	84
1914	88	90	98	93	100	100	100	97	95	98	92	90	95
1915	90	85	90	97	95	93	104	87	87	90	88	88	91
1916	88	85	92	95	104	100	104	104	98	98	98	102	97
1917	110	114	120	129	143	131	134	119	122	132	134	132	127
1918	131	139	144	148	168	158	165	148	151	156	137	144	149
1919	153	156	141	151	154	153	161	151	143	141	134	146	149
1920	143	148	168	153	154	146	139	136	120	134	110	104	138
1921	97	97	100	100	97	85	80	80	80	80	80	80	88
1922	76	75	83	95	85	76	75	68	76	80	76	76	79
1923	73	83	83	85	80	76	87	78	71	80	71	64	78
1924	83	78	78	80	76	75	81	75	76	68	76	71	77
1925	81	85	81	87	98	70	83	88	90	93	90	88	86
1926	85	93	98	100	97	97	97	102	95	110	92	95	97
1927	97	104	109	109	104	117	102	104	117	109	114	109	108
1928	124	119	126	131	132	139	136	141	148	134	134	132	133
1929	131	134	139	139	146	149	146	146	149	144	139	127	141
1930	137	131	119	126	129	127	93	88	88	93	87	81	108
1931	92	88	90	93	90	83	95	78	68	71	73	64	82
1932	73	68	70	66	66	59	59	63	55	56	51	47	61
1933	48	51	52	53	59	59	58	58	53	51	51	51	54
1934	53	54	54	58	56	56	53	53	59	59	57	57	56
1935	60	66	74	76	77	79	76	75	80	80	80	81	75
1936	84	87	87	90	88	92	92	90	90	88	88	92	89
1937	92	92	100	98	104	100	102	104	105	102	98	97	99
1938	97	95	100	104	104	104	104	102	107	104	98	98	101

TABLE 30. HOGS: AVERAGE PRICE PER 100 POUNDS RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	7.40	7.40	7.80	8.40	7.60	7.50	7.90	7.60	7.50	7.50	7.30	6.90	7.57
1911	7.20	6.40	6.80	6.00	6.00	6.20	6.00	6.40	6.70	6.00	5.80	5.60	6.26
1912	5.30	5.40	5.50	5.70	5.50	6.00	5.80	6.10	6.30	6.50	6.50	6.40	5.92
1913	6.00	6.00	6.10	6.20	6.10	6.20	5.90	6.60	6.70	6.70	6.60	6.80	6.33
1914	6.50	6.30	6.40	6.40	6.50	6.50	6.40	6.70	6.60	6.90	6.50	6.20	6.49
1915	6.00	5.60	5.70	5.70	5.80	5.80	6.10	5.80	5.70	5.90	5.80	5.70	5.80
1916	5.90	5.60	6.10	5.70	6.40	6.20	6.30	6.80	6.90	7.50	7.20	7.40	6.50
1917	7.40	7.70	9.20	10.40	10.40	10.70	10.40	11.20	12.50	14.10	13.80	14.70	11.04
1918	14.70	13.90	13.70	13.80	13.80	13.80	13.60	14.40	15.00	15.20	14.60	14.60	14.26
1919	14.00	13.70	13.90	15.00	15.60	15.20	16.70	16.80	15.10	12.90	12.30	12.20	14.45
1920	11.90	12.10	11.85	12.10	11.80	11.20	11.10	11.20	11.00	11.60	10.90	9.50	11.35
1921	8.60	8.00	7.90	7.90	7.20	6.70	6.80	7.20	7.00	7.30	7.00	6.20	7.32
1922	6.50	6.60	7.60	7.30	7.80	7.30	7.30	7.50	7.50	7.80	7.70	7.80	7.39
1923	7.20	7.00	7.20	6.80	6.70	6.40	6.30	6.20	6.90	6.70	6.50	6.50	6.70
1924	7.00	6.50	6.50	6.30	6.20	6.00	6.00	7.70	7.80	8.00	8.30	8.10	7.03
1925	8.40	8.50	9.70	9.10	8.60	6.90	10.20	10.20	10.40	10.10	10.40	10.50	9.42
1926	10.20	9.90	10.20	10.30	10.20	10.60	11.10	10.90	10.70	10.70	10.90	10.60	10.53
1927	9.60	10.20	9.60	9.30	9.00	8.60	8.60	8.70	9.10	9.10	8.80	8.50	9.09
1928	7.80	7.40	7.00	6.90	7.30	7.40	7.80	7.90	8.50	8.50	8.50	8.10	7.76
1929	7.50	7.70	7.70	8.00	8.40	8.20	8.10	8.50	8.40	8.70	8.20	8.20	8.13
1930	8.10	8.20	7.90	7.80	8.10	8.10	7.60	7.60	7.90	7.50	7.90	7.60	7.86
1931	7.00	6.40	6.50	6.80	6.70	6.20	5.80	5.80	5.50	4.90	5.00	4.80	5.95
1932	4.50	4.30	3.90	3.80	3.40	3.60	3.80	3.80	3.75	3.70	3.40	3.20	3.76
1933	3.00	2.90	2.95	3.00	3.25	3.40	3.40	3.30	3.10	3.40	3.40	3.40	3.21
1934	3.30	3.55	3.45	3.50	3.30	3.20	3.25	3.55	5.10	5.20	5.10	4.90	3.95
1935	5.10	5.30	5.90	6.00	5.70	6.20	6.10	7.20	7.90	8.50	7.90	7.60	6.62
1936	7.20	7.10	7.10	7.10	7.10	7.10	7.10	7.60	7.80	7.90	7.70	7.80	7.38
1937	7.80	7.50	7.30	7.60	7.50	7.70	7.90	8.80	8.30	8.30	7.70	7.20	7.80
1938	6.50	6.60	6.80	6.90	6.50	6.60	6.80	6.80	6.80	6.70	6.50	6.30	6.65

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 31. HOGS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1828 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	84	84	89	96	87	86	90	87	86	86	83	79	86
1911	82	73	78	68	68	71	68	73	76	68	66	64	71
1912	60	62	63	65	63	68	66	70	72	74	74	73	68
1913	68	68	70	71	70	71	67	75	76	76	75	78	72
1914	74	72	73	73	74	74	73	76	75	79	74	71	74
1915	68	64	65	65	66	66	70	66	65	67	66	65	66
1916	67	64	70	65	73	71	72	78	79	86	82	84	74
1917	84	88	105	119	119	122	119	128	143	161	157	168	126
1918	168	159	156	157	157	157	155	164	171	173	167	167	163
1919	160	156	159	171	178	173	191	192	172	147	140	139	165
1920	136	138	135	138	135	128	127	128	125	132	124	108	129
1921	98	91	90	90	82	76	78	82	80	83	80	71	84
1922	74	75	87	83	89	83	83	86	86	89	88	89	84
1923	82	80	82	78	76	73	72	71	79	76	74	74	76
1924	80	74	74	72	71	68	68	88	88	91	95	92	80
1925	96	97	111	104	98	79	116	116	119	115	119	120	107
1926	116	113	116	118	116	121	127	124	122	122	124	121	120
1927	110	116	110	106	103	98	98	99	104	104	100	97	104
1928	89	84	80	79	83	84	89	90	97	97	97	92	89
1929	86	88	88	91	96	94	92	97	96	99	94	94	93
1930	92	94	90	89	92	92	87	87	90	86	90	87	90
1931	80	73	74	78	76	71	66	66	63	56	57	55	68
1932	51	49	44	43	39	41	43	43	43	42	39	37	43
1933	34	33	34	34	37	39	39	38	35	39	39	39	37
1934	38	41	39	40	38	37	37	41	58	59	58	56	45
1935	58	60	67	68	65	71	70	82	90	97	90	87	76
1936	82	81	81	81	81	81	81	87	89	90	88	89	84
1937	89	86	83	87	86	88	90	100	95	95	88	82	89
1938	74	75	78	79	74	75	78	78	78	76	74	72	76

TABLE 32. SHEEP: AVERAGE PRICE PER 100 POUNDS RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	3.20	3.50	4.00	3.60	3.80	4.30	3.60	3.00	3.90	3.60	3.90	3.80	3.68
1911	3.70	3.80*	3.90	3.50	4.00	3.90	3.90	3.00	3.10	3.30	2.90	2.70	3.48
1912	3.00	3.00	3.40	3.30	4.00	4.10	3.90	3.20	3.70	3.20	3.50	3.20	3.46
1913	3.60	3.20	3.80	3.90	3.40	3.60	3.90	4.10	4.30	4.20	3.80	3.60	3.78
1914	3.70	4.20	4.00	4.00	4.60	4.00	4.00	4.00	4.30	3.50	4.10	3.70	4.00
1915	3.90	4.00	4.30	4.00	4.00	4.50	5.60	4.00	3.40	4.00	3.50	3.20	4.03
1916	3.60	4.40	3.70	4.60	4.90	4.00	4.10	4.60	4.30	4.60	4.30	4.70	4.32
1917	4.90	5.10	6.40	6.00	7.70	7.20	6.80	6.30	5.90	5.50	6.30	6.60	6.23
1918	7.10	7.90	9.30	8.10	9.20	9.00	9.80	8.70	9.50	9.90	9.00	9.90	8.95
1919	8.00	8.70	8.70	10.00	9.10	8.30	9.20	8.20	8.10	8.10	7.30	7.80	8.46
1920	7.40	8.50	8.30	8.25	9.70	8.10	7.10	6.50	6.70	6.30	5.50	5.40	7.31
1921	4.90	5.30	4.70	4.70	4.40	3.80	4.00	4.50	4.00	5.40	4.40	5.20	4.61
1922	4.70	4.20	3.80	4.70	4.20	4.00	3.90	4.00	4.20	4.90	5.00	4.70	4.36
1923	4.60	4.70	4.50	4.30	4.90	4.60	4.10	4.20	4.10	5.00	4.00	3.50	4.38
1924	5.20	4.60	4.60	4.50	4.20	4.70	5.00	4.50	4.50	4.00	3.60	3.50	4.41
1925	4.60	5.30	4.50	4.00	4.50	4.10	5.20	5.20	4.80	4.50	5.50	4.60	4.73
1926	5.00	5.20	4.90	5.10	5.20	5.00	4.70	4.50	5.20	4.70	4.70	5.20	4.95
1927	5.10	5.90	5.80	5.60	6.00	5.20	5.00	4.50	5.00	5.20	5.40	5.10	5.32
1928	5.50	6.50	6.00	6.70	6.70	6.30	6.10	6.30	7.10	6.45*	5.80	5.95*	6.28
1929	6.10	6.35*	6.60	6.80	6.80	6.30	6.30	6.40	5.70	6.15*	6.60	6.10	6.35
1930	6.90	6.40	6.00	6.10	5.70	5.00	4.90	5.30	5.20	4.30	3.90	3.70	5.28
1931	3.60	4.00	3.60	4.50	4.30	4.00	4.10	3.90	3.30	3.20	3.40	3.00	3.74
1932	3.20	3.00	3.00	3.20	2.60	2.50	3.00	2.60	2.60	2.65	2.50	2.45	2.78
1933	2.35	2.45	2.50	2.25	2.90	3.15	3.10	3.10	2.60	2.50	2.90	2.25	2.67
1934	2.25	2.95	2.90	2.80	2.80	2.80	3.00	2.90	2.60	2.65	2.50	2.50	2.72
1935	2.75	3.75	3.75	3.75	3.30	3.30	3.00	2.90	3.10	3.50	4.00	4.00	3.43
1936	3.10	3.00	3.10	3.20	3.50	3.00	3.00	3.50	3.80	4.00	3.00	3.60	3.32
1937	3.90	4.10	4.10	3.70	3.80	3.80	3.80	4.00	3.90	3.90	3.80	3.80	3.88
1938	3.80	3.60	3.20	3.00	3.20	3.20	3.50	3.20	3.30	3.20	3.10	3.30	3.30

*Interpolated.

Data compiled from United States Department of Agriculture, Statistical **Bulletin No. 16,** and monthly issues of crops and markets.

TABLE 33. SHEEP: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	62	68	78	70	74	84	70	58	76	70	76	74	72
1911	72	74	76	68	78	76	76	58	60	64	56	53	68
1912	58	58	66	64	78	80	76	62	72	62	68	62	67
1913	70	62	74	76	66	70	76	80	84	82	74	70	74
1914	72	82	78	78	89	78	78	78	84	68	80	72	78
1915	76	78	84	78	78	88	109	78	66	78	68	62	78
1916	70	86	72	89	95	78	80	89	84	89	84	91	84
1917	95	99	125	117	150	140	132	123	115	107	123	128	121
1918	138	154	181	158	179	175	191	169	185	193	175	193	174
1919	156	169	170	195	177	161	179	160	157	157	142	152	165
1920	144	165	161	161	189	158	138	126	130	123	107	105	142
1921	95	103	91	91	86	74	78	88	78	105	86	101	90
1922	91	82	74	91	82	78	76	78	82	95	97	91	85
1923	89	91	88	84	95	89	80	82	80	97	78	68	85
1924	101	89	89	88	82	91	97	88	88	78	70	68	86
925	89	103	88	78	88	80	101	101	93	88	107	89	92
1926	97	101	95	99	101	97	91	88	101	91	91	101	96
1927	99	115	113	109	117	101	97	88	97	101	105	99	104
1928	107	126	117	130	130	123	119	123	138	125	112	116	122
1929	119	124	128	132	132	123	123	125	111	120	128	119	124
1930	134	125	117	119	111	97	95	103	101	84	76	72	103
1931	70	78	70	88	84	78	80	76	64	62	66	58	73
1932	62	58	58	62	51	49	58	51	51	52	49	48	54
1933	46	48	49	44	56	61	60	60	51	49	56	44	52
1934	44	57	56	54	54	54	58	56	51	52	49	49	53
1935	54	73	73	73	64	64	58	56	60	68	78	78	67
1936	60	58	60	62	68	58	58	68	74	78	58	70	65
1937	76	80	80	72	74	74	74	78	76	76	74	74	75
1938	74	70	62	58	62	62	68	62	64	62	60	64	64

TABLE 34. LAMBS: AVERAGE PRICE PER 100 POUNDS RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	3.70	5.00	6.00	5.30	4.00	5.50	4.10	3.10	4.50	4.80	4.60	4.40	4.58
1911	4.70	4.85*	5.00	4.00	4.90	3.50	4.10	4.00	3.70	3.80	3.00	3.80	4.11
1912	4.00	4.00	4.00	3.80	3.50	4.80	4.10	3.50	4.80	4.00	3.90	3.70	4.01
1913	4.00	4.10	5.00	4.60	4.00	4.50	4.70	5.10	5.40	5.00	4.20	4.60	4.60
1914	4.30	5.40	5.00	5.10	5.20	5.20	5.10	5.20	5.60	4.60	4.90	4.60	5.02
1915	5.50	5.20	5.80	5.00	5.70	6.40	6.80	5.30	5.10	5.50	5.10	5.50	5.58
1916	5.30	5.70	5.30	6.00	6.40	5.30	5.60	5.90	5.70	6.50	6.20	6.20	5.84
1917	6.00	6.50	8.00	8.00	9.60	9.10	9.50	9.00	8.10	10.00	9.70	10.70	8.68
1918	9.20	10.50	11.10	11.00	11.00	10.90	12.00	11.00	10.30	11.70	10.50	11.60	10.90
1919	9.70	11.60	11.80	11.80	11.20	11.20	11.10	12.10	10.30	10.30	9.30	9.90	10.86
1920	10.10	11.50	11.20	10.10	12.00	10.70	9.80	8.90	8.80	8.30	6.90	6.90	9.60
1921	7.20	6.90	6.60	6.60	6.50	5.50	5.40	5.40	5.40	5.70	5.70	5.90	6.07
1922	5.50	5.60	6.70	7.60	6.10	7.00*	7.90	6.00	6.50	6.30	7.00	6.50	6.56
1923	6.80	8.10	7.40	6.00	7.10	7.50	7.50	7.00	6.30	7.70	6.50	5.60	6.96
1924	7.00	6.20	6.20	6.00	6.50	6.70	6.50	5.80	6.20	5.60	5.30	5.00	6.08
1925	6.50	7.60	6.60	6.20	7.10	6.80	9.90	8.00*	6.10	6.20	9.00	6.90	7.24
1926	6.70*	6.50	7.60	7.00	7.60	7.50	9.00	8.00	8.00	7.50	7.80	8.60	7.65
1927	8.70	9.00	8.50	8.80	8.90	8.00	7.30	8.50	8.60	7.60	9.10	8.80	8.48
1928	8.60	11.00	10.00	10.00	11.00	11.00	10.00	9.50	10.20	8.60	9.00	8.60	9.79
1929	9.80	9.50	10.50	10.40	10.70	10.30	9.80	9.90	8.80	9.50	9.60	9.20	9.83
1930	9.30	9.70	8.90	8.40	8.30	9.70	8.40	7.70	7.70	7.00	6.50	5.50	7.45
1931	5.20	6.10	5.40	6.30	6.00	6.00	5.80	5.80	5.50	4.50	5.50	5.20	5.61
1932	5.50	6.00	5.00	5.00	5.10	4.60	4.50	4.30	4.40	4.35	3.50	3.55	4.65
1933	3.55	3.75	4.25	4.00	4.60	5.00	4.75	4.40	3.95	4.10	4.75	4.00	4.26
1934	3.70	4.00	4.00	4.20	4.20	4.10	4.60	3.90	3.60	3.65	4.00	4.00	4.00
1935	4.00	4.50	4.75	5.00	4.80	5.30	5.00	4.90	5.00	6.60	6.00	6.00	5.15
1936	5.40	5.20	5.00	5.20	6.00	5.30	5.80	5.80	5.60	6.50	5.00	5.70	5.54
1937	5.90	6.20	6.20	6.00	6.00	5.30	5.30	6.40	6.40	6.30	6.00	6.00	6.00
1938	5.70	5.50	5.50	5.30	5.50	5.50	5.00	5.10	5.00	5.00	5.00	5.20	5.28

*Interpolated.

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 35. LAMBS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	47	64	76	68	51	70	52	39	57	61	59	56	58
1911	60	62	64	51	62	45	52	51	47	48	38	48	52
1912	51	51	51	48	45	61	52	45	61	51	50	47	51
1913	51	52	64	59	51	57	60	65	69	64	54	59	59
1914	55	69	64	65	66	66	65	66	71	59	62	59	64
1915	70	66	74	64	73	82	87	68	65	70	65	70	71
1916	68	73	68	76	82	68	71	75	73	83	79	79	74
1917	76	83	102	102	122	116	121	115	103	127	124	136	111
1918	117	134	141	140	140	139	153	140	131	149	134	148	139
1919	124	148	150	150	143	143	141	154	131	131	118	126	138
1920	129	146	143	129	153	136	125	113	112	106	88	88	122
1921	92	88	84	84	83	70	69	69	69	73	73	75	77
1922	70	71	85	97	78	89	101	76	83	80	89	83	84
1923	87	103	94	76	90	96	96	89	80	98	83	71	89
1924	89	79	79	76	83	85	83	74	79	71	68	64	77
1925	83	97	84	79	90	87	126	102	78	79	115	88	92
1926	85	83	97	89	97	96	115	102	102	96	99	110	97
1927	111	115	108	112	113	102	93	108	110	97	116	112	108
1928	110	140	127	127	140	140	127	121	130	110	115	110	125
1929	125	121	134	132	136	131	125	126	112	121	122	117	125
1930	118	124	113	107	106	124	107	98	98	89	83	70	95
1931	66	78	69	80	76	76	74	74	70	57	70	66	71
1932	70	76	64	64	65	59	57	55	56	55	45	45	59
1933	45	48	54	51	59	64	61	56	50	52	61	51	54
1934	47	51	51	54	54	52	59	50	46	46	51	51	51
1935	51	57	61	64	61	68	64	62	64	84	76	76	66
1936	69	66	64	66	76	68	74	74	71	83	64	73	71
1937	75	79	79	76	76	68	68	82	82	80	76	76	76
1938	73	70	70	68	70	70	64	65	64	64	64	66	67

TABLE 36. POTATOES: AVERAGE PRICE PER BUSHEL RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	1.06	1.12	1.20	1.18	1.06	.97	.92	.94	.96	.94	.93	.96	1.02
1911	1.00	1.06	1.14	1.18	1.06	1.04	1.16	1.41	1.50	1.28	1.16	1.20	1.18
1912	1.28	1.38	1.48	1.49	1.40	1.25	1.14	1.10	1.03	.94	.90	.86	1.19
1913	.99	1.14	1.14	1.10	1.08	1.00	.88	.94	1.02	1.04	1.02	1.04	1.03
1914	1.06	1.09	1.14	1.12	1.06	.98	1.02	1.06	1.05	1.00	.95	.98	1.04
1915	1.02	1.10	1.14	1.06	1.08	1.00	.84	.80	.84	.83	.80	.86	.95
1916	.94	1.24	1.37	1.22	1.11	1.05	1.04	1.06	1.19	1.38	1.53	1.58	1.23
1917	1.78	2.40	3.03	3.26	2.90	2.50	2.26	1.91	1.80	1.80	1.72	1.80	2.26
1918	1.94	2.33	2.46	1.98	1.44	1.16	1.22	1.32	1.52	1.65	1.65	1.72	1.70
1919	1.79	1.92	2.06	2.02	1.93	1.89	1.88	1.90	1.95	1.94	1.88	1.96	1.93
1920	2.12	2.74	3.47	4.06	4.40	4.24	4.00	3.32	2.64	2.12	1.89	1.90	3.08
1921	1.84	1.92	1.96	1.84	1.55	1.27	1.36	1.68	1.80	1.86	1.97	2.02	1.76
1922	1.88	2.04	2.36	2.18	1.80	1.58	1.54	1.45	1.53	1.74	1.70	1.60	1.78
1923	1.60	1.70	1.90	1.86	1.72	1.66	1.60	1.70	1.65	1.52	1.54	1.64	1.67
1924	1.90	1.75	1.75	1.72	1.60	1.40	1.05	1.40	1.20	1.90	1.65	1.55	1.57
1925	1.70	1.90	1.84	1.48	1.80	2.10	1.70	2.00	1.91	1.82	2.81	2.47	1.96
1926	3.25	3.13*	3.00	3.20	3.30	2.70	2.00	1.70	2.00	1.80	2.00	1.70	2.48
1927	1.70	1.80	2.40	2.35	2.00	2.15	2.20	1.90	1.70	1.70	1.75	1.65	1.94
1928	1.60	1.70	2.10	2.15	2.10	1.30	1.05	1.10	1.15	1.15	1.20	1.05	1.47
1929	1.20	1.20	1.15	1.35	1.45	1.55	1.50	1.50	1.65	1.60	1.65	1.55	1.45
1930	1.45	1.45	1.40	1.50	1.50	1.45	1.35	1.45	1.60	1.50	1.40	1.40	1.45
1931	1.35	1.45	1.45	1.45	1.40	.85	.75	.70	.70	.70	.85	.75	1.03
1932	.77	.95	.95	1.08	.90	.70	.60	.65	.70	.70	.70	.70	.78
1933	.70	.75	.80	.85	.95	.85	.90	1.20	1.20	1.05	1.00	.95	.93
1934	1.00	1.20	1.40	1.20	1.20	.65	.70	.80	.95	1.00	.95	1.00	1.00
1935	1.05	1.20	1.22	1.12	.90	.90	.75	.85	.90	.85	.85	.95	.96
1936	.95	1.00	1.10	1.10	1.15	1.45	1.40	1.45	1.40	1.35	1.40	1.40	1.26
1937	1.40	1.75	1.75	1.75	1.50	.55	.73	.95	.95	.95	.90	.90	1.17
1938	.95	1.00	1.00	.95	.75	.60	.80	.85	.85	.80	.85	.95	.86

*Interpolated.

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 37. POTATOES: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	56	59	64	63	56	51	49	50	51	50	49	51	54
1911	53	56	60	63	56	55	62	75	80	68	62	64	63
1912	68	73	78	79	74	66	60	58	55	50	48	46	63
1913	53	60	60	58	57	53	47	50	54	55	54	55	55
1914	56	58	60	59	56	52	54	56	56	53	50	52	55
1915	54	58	60	56	57	53	45	42	45	44	42	46	50
1916	50	66	73	65	59	56	55	56	63	73	81	84	65
1917	94	127	161	173	154	133	120	101	95	95	91	95	120
1918	103	124	130	105	76	62	65	70	81	88	88	91	90
1919	95	102	109	107	102	100	100	101	103	103	100	104	102
1920	112	145	184	215	233	225	212	176	140	112	100	101	163
1921	98	102	104	98	82	67	72	89	95	99	104	107	93
1922	100	108	125	116	95	84	82	77	81	92	90	85	94
1923	85	90	101	99	91	88	85	90	88	81	82	87	89
1924	101	93	93	91	85	74	56	74	64	101	88	82	83
1925	90	101	98	78	95	111	90	106	101	97	149	131	104
1926	172	166	159	170	175	143	106	90	106	95	106	90	131
1927	90	95	127	125	106	114	117	101	90	90	93	88	103
1928	85	90	111	114	111	69	56	58	61	61	64	56	78
1929	64	64	61	72	77	82	80	80	88	85	88	82	77
1930	77	77	74	80	80	77	72	77	85	80	74	74	77
1931	72	77	77	77	74	45	40	37	37	37	45	40	55
1932	41	50	50	57	48	37	32	34	37	37	37	37	41
1933	37	40	42	45	50	45	48	64	64	56	53	50	49
1934	53	64	74	64	64	34	37	42	50	53	50	53	53
1935	56	64	65	59	48	48	40	45	48	45	45	50	51
1936	50	53	58	58	61	77	74	77	74	72	74	74	67
1937	74	93	93	93	80	29	39	50	50	50	48	48	62
1938	50	53	53	50	40	32	42	45	45	42	45	50	46

TABLE 38. SWEET POTATOES: AVERAGE PRICE PER BUSHEL RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	.77	.79	.81	.81	1.00	.77	.76	.75	.82	.80	.62	.65	.78
1911	.70	.71	.77	.82	.87	.86	.81	.83	.81	.79	.60	.62	.77
1912	.67	.75	.75	.85	.95	99	.89	.91	.86	.74	.68	.67	.81
1913	.74	.78	.84	.80	.80	.80	.80	.88	.82	.72	.62	.62	.77
1914	.70	.77	.75	.85	.80	.80	.80	.76	.76	.71	.57	.59	.74
1915	.67	.71	.80	.85	.79	.78	.85	.82	.70	.61	.50	.53	.72
1916	.61	.67	.68	.67	.65	.69	.74	.86	.75	.60	.60	.65	.68
1917	.75	.80	.95	1.00	1.10	1.05	1.10	1.05	1.00	.95	.85	.95	.96
1918	1.00	1.20	1.50	1.35	1.20	1.00	1.00	1.25	1.25	1.30	1.12	1.04	1.18
1919	1.03	1.25	1.40	1.40	1.40	1.50	1.20	1.70	1.70	1.50	1.30	1.20	1.38
1920	1.35	1.40	1.60	1.60	1.70	1.70	1.60	1.80	1.71	1.25	1.01	.85	1.46
1921	1.13	1.20	1.18	1.10	1.30	1.53	1.75	1.49	.90	1.03	.82	.82	1.19
1922	.92	1.03	1.11	1.10	1.05	1.00	1.25	1.00	1.00	.83	.70	.75	.98
1923	.76	.81	.92	.94	.90	1.00	.90	1.13	1.21	1.02	.92	.98	.96
1924	1.03	1.10	1.20	1.50	1.43	1.46	1.30	1.40	1.40	2.10	1.62	1.68	1.44
1925	2.00	2.08	2.46	2.30	1.94	2.01	2.02	1.88	1.56	1.50	1.40	.98	1.84
1926	1.06	1.25	1.36	1.45	1.50	1.75	1.50	1.70	1.70	1.20	.95	.85	1.36
1927	.90	1.15	1.10	1.15	1.45	1.50	1.70	1.45	1.20	1.00	.80	.85	1.19
1928	.90	.90	1.00	1.00	1.10	1.10	1.00	1.40	1.30	1.15	.95	1.00	1.07
1929	1.05	1.15	1.15	1.20	1.20	1.25	1.30	1.25	1.15	1.00	.80	.80	1.11
1930	.85	.95	1.00	1.00	1.05	1.05	1.05	1.25	1.35	1.10	.85	.90	1.03
1931	.90	.90	.95	1.00	1.00	1.00	.80	.90	.65	.60	.50	.50	.81
1932	.50	.55	.55	.55	.55	.55	.55	.60	.55	.45	.34	.33	.51
1933	.37	.39	.43	.45	.50	.50	.60	.85	.75	.60	.55	.60	.55
1934	.65	.70	.75	.80	.80	.85	.85	.90	.80	.75	.60	.60	.75
1935	.62	.65	.65	.70	.70	.70	.75	.85	.80	.65	.65	.65	.70
1936	.65	.70	.70	.70	.75	.75	.90	1.10	1.05	.90	.80	.81	.82
1937	.90	.90	.95	1.00	1.05	.95	.95	1.15	.95	.80	.60	.65	.90
1938	.70	.80	.80	.75	.80	.75	.90	.85	.75	.65	.60	.60	.75

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 39. SWEET POTATOES: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	56	57	59	59	73	56	55	54	60	58	45	47	57
1911	51	52	56	60	63	62	59	60	59	57	44	45	56
1912	49	54	54	62	69	72	65	66	62	54	49	49	59
1913	54	57	61	58	58	58	58	64	60	52	45	45	56
1914	51	56	54	62	58	58	58	55	55	52	41	43	54
1915	49	52	58	62	57	57	62	60	51	44	36	38	52
1916	44	49	49	49	47	50	54	62	54	44	44	47	49
1917	54	58	69	73	80	76	80	76	73	69	62	69	70
1918	73	87	109	98	87	73	73	91	91	94	81	75	86
1919	75	91	102	102	102	109	87	123	123	109	94	87	100
1920	98	102	116	116	123	123	116	131	124	91	73	62	106
1921	82	87	86	80	94	111	127	108	65	75	60	60	86
1922	67	75	81	80	76	73	91	73	73	60	51	54	71
1923	55	59	67	68	65	73	65	82	88	74	67	71	70
1924	75	80	87	109	104	106	94	102	102	152	118	122	105
1925	145	151	179	167	141	146	147	136	113	109	102	71	134
1926	77	91	99	105	109	127	109	123	123	87	69	62	99
1927	65	83	80	83	105	109	123	105	87	73	58	62	86
1928	65	65	73	73	80	80	73	102	94	83	69	73	78
1929	76	83	83	87	87	91	94	91	83	73	58	58	81
1930	62	69	73	73	76	76	76	91	98	80	62	65	75
1931	65	65	69	73	73	73	58	65	47	44	36	36	59
1932	36	40	40	40	40	40	40	44	40	33	25	24	37
1933	27	28	31	33	36	36	44	62	54	44	40	44	40
1934	47	51	54	58	58	62	62	65	58	54	44	44	54
1935	45	47	47	51	51	51	54	62	58	47	47	47	51
1936	47	51	51	51	54	54	65	80	76	65	58	59	60
1937	65	65	69	73	76	69	69	83	69	58	44	47	65
1938	51	58	58	54	58	54	65	62	54	47	44	44	54

TABLE 40. MILK COWS: PRICE PER HEAD RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	27.20	28.20	31.40	29.20	31.00	29.50	29.80	30.90	27.00	27.50	30.00	28.70	29.20
1911	31.20	29.00	30.00	28.40	28.90	30.30	28.20	28.90	29.50	29.90	29.60	28.00	29.33
1912	27.70	28.00	28.60	29.50	29.80	28.70	29.80	28.70	29.70	29.20	28.90	29.30	28.99
1913	30.50	31.60	33.40	33.30	35.10	33.50	34.20	35.90	36.80	38.20	37.60	36.00	34.68
1914	36.80	36.90	38.20	38.90	40.90	40.50	41.50	40.20	40.00	40.70	36.30	36.80	38.98
1915	38.00	36.80	38.30	37.00	38.50	36.80	37.20	37.20	37.50	38.10	35.70	36.60	37.31
1916	36.90	35.80	36.30	37.50	39.80	38.10	39.10	38.00	38.00	39.90	38.60	41.00	38.25
1917	40.60	41.40	42.50	48.60	47.20	50.00	53.00	51.80	51.10	50.00	50.90	55.10	48.52
1918	57.80	60.00	64.30	65.40	65.80	68.00	66.40	66.60	70.00	68.70	65.20	72.00	65.85
1919	68.00	68.30	71.00	69.00	73.20	73.40	78.10	72.70	74.40	70.00	69.50	66.80	71.20
1920	72.50	72.80	69.80	72.90	69.00	74.50	66.70	65.40	60.70	62.60	54.00	47.00	65.66
1921	40.10	43.00	43.00	43.00	44.00	39.00	38.00	36.00	38.00	34.10	34.00	34.10	38.86
1922	31.00	28.10	30.70	32.40	33.40	33.00	31.00	34.00	30.00	31.70	33.00	29.00	31.48
1923	27.80	29.40	29.60	29.00	30.20	32.50	30.70	30.80	29.10	33.20	31.50	31.10	30.41
1924	30.00	32.00	32.00	32.50	33.40	32.50	30.00	33.00	31.20	30.10	30.80	28.00	31.29
1925	30.00	30.40	30.30	31.20	31.00	29.50	30.30	31.50	29.90	35.40	36.30	34.60	31.70
1926	33.30	37.10	36.00	35.00	38.00	38.00	38.00	39.00	37.00	39.00	38.00	41.00	37.00
1927	39.00	42.00	43.00	43.00	45.00	44.00	45.00	43.00	50.00	50.00	50.00	53.00	46.00
1928	48.00	55.00	53.00	55.00	54.00	56.00	56.00	54.00	54.00	54.00	59.00	55.00	54.00
1929	55.00	55.00	55.00	54.00	59.00	58.00	57.00	57.00	57.00	57.00	58.00	56.00	57.00
1930	56.00	53.00	53.00	53.00	53.00	49.00	42.00	36.00	37.00	37.00	37.00	33.00	45.00
1931	31.00	34.00	34.00	35.00	35.00	31.00	30.00	28.00	25.00	25.00	27.00	26.00	30.00
1932	24.00	23.00	24.00	26.00	24.00	23.00	22.00	22.00	21.00	20.00	19.00	18.00	22.00
1933	18.00	17.00	18.00	19.00	19.00	21.00	21.00	21.00	19.00	20.00	19.00	20.00	19.00
1934	19.00	20.00	20.00	21.00	20.00	20.00	20.00	19.00	20.00	20.00	20.00	21.00	20.00
1935	22.00	22.00	22.00	23.00	23.00	24.00	23.00	23.00	24.00	23.00	24.00	25.00	23.00
1936	26.00	26.00	27.00	28.00	30.00	30.00	31.00	30.00	32.00	32.00	33.00	32.00	30.00
1937	33.00	32.00	33.00	34.00	35.00	34.00	34.00	34.00	33.00	34.00	33.00	31.00	33.00
1938	31.00	33.00	33.00	33.00	33.00	33.00	33.00	34.00	34.00	33.00	33.00	34.00	33.00

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 41. MILK COWS: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	68	70	78	73	77	74	74	77	67	69	75	72	73
1911	78	72	75	71	72	76	70	72	74	75	74	70	73
1912	69	70	71	74	74	72	74	72	74	73	72	73	72
1913	76	79	83	83	88	84	85	90	92	95	94	90	87
1914	92	92	95	97	102	101	104	100	100	102	91	92	97
1915	95	92	96	92	96	92	93	93	94	95	89	91	93
1916	92	89	91	94	99	95	98	95	95	100	96	102	95
1917	101	103	106	121	118	125	132	129	127	125	127	137	121
1918	144	150	160	163	164	170	166	166	175	171	163	180	164
1919	170	170	177	172	183	183	195	181	186	175	173	167	178
1920	181	182	174	182	172	186	166	163	151	156	135	117	164
1921	100	107	107	107	110	97	95	90	95	85	85	85	97
1922	77	70	77	81	83	82	77	85	75	79	82	72	79
1923	69	73	74	72	75	81	77	77	73	83	79	78	76
1924	75	80	80	81	83	81	75	82	78	75	77	70	78
1925	75	76	76	78	77	74	76	79	75	88	91	86	79
1926	83	93	90	87	95	95	95	97	92	97	95	102	92
1927	97	105	107	107	112	110	112	107	125	125	125	132	115
1928	120	137	132	137	135	140	140	135	135	135	147	137	135
1929	137	137	137	135	147	145	142	142	142	142	145	140	142
1930	140	132	132	132	132	122	105	90	92	92	92	82	112
1931	77	85	85	87	87	77	75	70	62	62	67	65	75
1932	60	57	60	65	60	57	55	55	52	50	47	45	55
1933	45	42	45	47	47	52	52	52	47	50	47	50	47
1934	47	50	50	52	50	50	50	47	50	50	50	52	50
1935	55	55	55	57	57	60	57	57	60	57	60	62	57
1936	65	65	67	70	75	75	77	75	80	80	82	80	75
1937	82	80	82	85	87	85	85	85	82	85	82	77	82
1938	77	82	82	82	82	82	82	85	85	82	82	85	82

TABLE 42. HAY (LOOSE): AVERAGE PRICE PER TON RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	12.10	12.60	12.85	12.95	12.90	12.60	12.00	11.70	11.45	11.45	11.85	11.90	12.20
1911	11.75	11.90	11.50	10.90	10.45	10.65	11.35	11.40	11.80	12.10	11.40	10.85	11.34
1912	11.05	11.80	12.30	12.90	13.95	14.30	13.85	12.90	11.95	11.50	11.90	12.75	12.60
1913	12.50	12.85	13.20	12.00	12.20	12.65	12.10	12.09	12.25	12.90	13.45	13.35	12.63
1914	13.35	13.50	13.50	13.60	13.75	13.35	13.05	12.95	12.50	12.25	12.10	12.22	13.01
1915	12.36	12.10	12.25	12.95	12.80	12.70	11.90	10.60	10.75	11.40	11.40	11.00	11.85
1916	11.50	11.70	11.50	11.95	12.15	11.55	11.10	11.00	10.55	10.15	10.55	11.00	11.23
1917	11.35	11.60	12.25	13.20	13.60	13.75	13.45	13.20	13.20	13.75	14.80	16.05	13.35
1918	17.80	18.30	19.15	18.80	17.05	16.55	16.45	16.70	16.65	18.35	19.25	19.35	17.87
1919	20.60	21.25	21.10	21.25	22.25	22.95	22.85	21.50	19.90	19.75	20.35	21.35	21.26
1920	22.75	23.75	24.20	25.40	25.15	25.00	25.05	23.05	21.25	18.90	17.40	17.10	22.42
1921	16.50	16.05	16.15	15.85	15.50	14.70	14.00	14.80	14.95	13.00	13.05	14.30	14.90
1922	13.30	13.25	14.55	15.05	15.20	14.95	13.75	12.90	12.90	13.10	13.85	13.55	13.86
1923	13.15	14.75	15.20	15.00	15.05	15.75	15.40	14.20	13.25	12.70	14.20	14.00	14.39
1924	14.80	15.30	15.00	16.00	16.50	17.00	16.00	13.30	13.70	15.00	16.50	15.60	15.39
1925	15.30	16.00	17.80	19.10	16.80	14.30	14.70	14.40	13.60	15.40	16.70	15.10	15.77
1926	16.00	16.30	16.40	15.30	16.70	18.00	15.20	14.80	14.50	14.80	14.80	14.40	15.60
1927	14.00	14.40	14.50	14.50	14.50	15.00	15.50	14.70	14.00	13.00	13.00	12.60	14.14
1928	12.70	13.20	14.70	14.30	14.30	14.30	13.10	12.70	12.80	12.70	13.50	13.20	13.46
1929	14.10	14.10	14.00	14.00	14.60	14.30	14.30	13.30	13.30	13.30	13.30	13.60	13.85
1930	13.60	13.90	14.00	14.40	14.60	14.30	14.30	14.20	14.50	14.50	14.50	13.90	14.23
1931	14.00	14.60	13.60	13.90	13.80	13.80	11.60	10.90	9.80	7.60	7.30	6.80	11.48
1932	7.20	7.00	7.80	7.30	7.30	7.00	7.00	7.30	7.30	7.30	6.70	6.40	7.13
1933	6.60	6.50	6.60	7.50	8.50	8.60	9.10	8.70	7.70	8.40	8.30	9.00	7.96
1934	9.00	9.50	10.00	10.10	10.30	10.30	9.90	9.40	9.70	10.70	11.00	10.50	10.03
1935	11.50	11.80	11.70	11.70	12.20	11.00	11.00	9.50	10.50	9.90	10.50	10.00	10.94
1936	10.30	10.50	11.50	11.80	10.90	10.00	10.00	10.00	10.10	10.90	10.70	11.00	10.64
1937	11.00	12.00	12.30	12.80	13.10	11.20	11.00	10.00	10.00	9.70	9.40	9.40	10.99
1938	9.60	10.10	10.60	10.20	10.10	10.30	9.60	8.90	8.30	8.70	7.70	8.50	9.38

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 43. HAY (LOOSE): RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	81	85	86	87	87	85	81	79	77	77	80	80	82
1911	79	80	77	73	77	72	76	77	79	81	77	73	76
1912	74	79	83	87	94	96	93	87	80	77	80	86	85
1913	84	86	89	81	82	85	81	81	82	87	90	90	85
1914	90	91	91	91	92	90	88	87	84	82	81	82	87
1915	90	81	82	87	86	85	80	71	72	77	77	74	80
1916	77	79	77	80	82	78	75	74	71	75	71	74	76
1917	76	78	82	89	91	92	90	89	89	92	100	108	90
1918	120	123	129	126	115	111	111	112	112	123	129	130	120
1919	139	143	142	143	150	154	154	145	134	133	137	144	143
1920	153	160	163	171	169	168	168	155	143	127	117	115	151
1922	111	108	109	107	104	99	94	100	101	87	88	96	100
1922	89	89	98	101	102	101	92	87	87	88	93	91	93
1923	88	99	102	101	101	106	104	95	89	85	95	94	97
1924	100	103	101	108	111	114	108	89	92	101	111	105	103
1925	103	108	120	128	113	96	99	97	91	104	112	102	106
1926	108	110	110	103	112	121	102	100	98	100	100	97	105
1927	94	97	98	98	98	101	104	99	94	87	87	85	95
1928	85	89	99	96	96	96	88	85	86	85	91	89	91
1929	95	95	94	94	98	96	96	89	89	89	89	91	93
1930	91	93	94	97	98	96	96	95	98	98	98	93	96
1931	94	98	91	93	93	93	78	73	66	51	49	46	47
1932	48	47	52	49	49	47	47	49	49	49	45	43	48
1933	44	44	44	50	57	58	61	59	52	56	56	61	54
1934	61	64	67	68	69	69	67	63	65	72	74	71	67
1935	77	79	79	72	82	74	74	64	71	67	71	67	74
1936	69	71	77	73	73	74	67	67	68	73	72	74	72
1937	74	81	83	86	88	75	74	67	67	65	63	63	74
1938	65	68	71	69	68	69	65	60	56	59	52	57	63

TABLE 44. WOOL: UNWASHED: AVERAGE PRICE PER POUND RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938.

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	30	29	29	18	29	25	24	26	15	17	17	17	23
1911	17	18	15	16	16	15	16	18	16	16	17	15	16
1912	17	16	18	15	14	16	20	18	17	17	17	17	17
1913	17	17	19	17	17	16	15	16	16	17	17	17	17
1914	15	15	16	15	16	16	16	18	16	15	16	16	16
1915	16	16	16	17	17	19	20	22	19	19	20	19	18
1916	20	17	18	21	24	24	24	24	23	24	25	25	22
1917	26	24	26	27	30	37	37	36	35	37	39	41	33
1918	43	43	45	43	45	44	43	49	45	47	46	53	46
1919	45	44	48	46	42	39	47	44	44	41	39	38	43
1920	41	45	38	40	40	31	25	25	20	19	20	17	30
1921	20	17	17	18	17	14	14	14	14	14	15	13	16
1922	10	14	12	12	13	22	30	24	25	23	20	20	19
1923	21	16	18	20*	22	28	24	20	24	28	26*	26*	23
1924	24	23	23	23	25	24	25	34	32*	29	......	......	26[1]
1925	......	......	......	26	30	35	34	32	31	34	30	35	32[2]
1926	38	37	33	33	28	28	28	33	34	33	30	32	32
1927	28	27	30	28	29	27	29	28	32	30	30	31	29
1928	30	29	27	30	32	35	37	35	36	35	35	34	33
1929	32	31	32	33	35	32	33	33	31	33	31	32	32
1930	31	28	27	26	21	20	21	21	21	22	20	19	25
1931	19	19	18	15	14	13	13	14	13	12	13	12	15
1932	13	12	13	11*	10*	8*	7	8	9	9	10	10	10
1933	10	9	9	9	12	18	22	24	22	22	22	23	17
1934	24	25	24	24	23	23	22	21	20	20	20	19	22
1935	19	20	18	16	16	18	20	19	21	21	22	23	19
1936	20	21	20	22	22	25	25	25	26	25	27	27	24
1937	27	25	27	27	31	31	31	34	33	30	26	23	29
1938	21	21	20	20	20	19	19	19	19	19	19	19	20

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

*Interpolated.

[1] 10 months average.

[2] 9 months average.

TABLE 45. WOOL. UNWASHED: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	98	95	95	59	95	82	79	85	49	56	56	56	75
1911	56	59	49	52	52	49	52	59	52	52	56	49	52
1912	56	52	59	49	46	52	65	59	56	56	56	56	56
1913	56	56	62	56	56	52	49	52	52	56	56	56	56
1914	49	49	52	49	52	52	52	59	52	52	52	52	52
1915	52	52	52	56	56	62	65	72	62	62	65	62	59
1916	65	56	59	69	79	79	79	79	75	79	82	82	72
1917	85	79	85	88	98	121	121	118	115	121	128	134	108
1918	141	141	147	141	147	144	141	160	147	154	151	173	151
1919	147	144	157	151	137	128	154	144	144	134	128	124	141
1920	134	147	124	131	131	101	82	82	65	62	65	56	98
1921	65	56	56	59	56	46	46	46	46	46	49	43	52
1922	33	46	39	39	43	72	98	79	82	75	65	65	62
1923	69	52	59	65	72	92	79	65	79	92	85	85	75
1924	79	75	75	75	82	79	82	111	105	95	......	......	85
1925	......	......	......	85	98	115	111	105	101	111	98	115	105
1926	124	121	108	108	92	92	92	108	111	108	98	105	105
1927	92	88	98	92	95	88	95	92	105	98	98	101	95
1928	98	95	88	98	105	115	121	115	118	115	115	111	108
1929	105	101	105	108	115	105	108	108	101	108	101	105	105
1930	101	92	88	85	69	65	69	69	69	72	65	62	82
1931	62	62	59	49	46	43	43	46	43	39	43	39	49
1932	43	39	43	36	33	26	23	26	29	29	33	33	33
1933	33	29	29	29	39	59	72	79	72	72	72	75	56
1934	79	82	79	79	75	75	72	69	65	65	65	62	72
1935	62	65	59	52	52	59	65	62	69	69	72	75	62
1936	65	69	65	72	72	82	82	82	85	82	88	88	79
1937	88	82	88	88	101	101	101	111	108	98	85	75	95
1938	69	69	65	65	65	62	62	62	62	62	62	62	65

TABLE 46. HORSES: AVERAGE PRICE PER HEAD RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1910	122	109	131	131	134	123	122	125	123	123	122	119	124
1911	126	122	126	122	124	114	124	118	119	117	113	113	120
1912	106	104	109	111	119	117	119	115	116	121	119	115	114
1913	115	119	121	115	120	122	123	126	120	119	110	115	119
1914	118	119	122	121	119	119	120	125	115	108	107	103	116
1915	105	104	112	110	110	107	109	104	106	111	105	107	108
1916	106	109	113	110	110	110	111	108	100	104	100	100	107
1917	104	107	107	109	110	106	114	113	115	113	115	125	112
1918	121	122	133	134	130	128	126	127	126	125	126	130	127
1919	124	126	133	130	136	130	133	131	130	130	122	112	128
1920	133	129	129	135	124	126	131	121	116	107	90	88	119
1921	83	80	80	80	81	77	76	75	80	73	70	73	77
1922	72	62	69	75	74	75	76	75	75	72	75	70	73
1923	67	66	70	71	73	77	75	72	70	71	65	64	70
1924	63	64	64	63	65	67	66	70	67	64	67	64	65
1925	65	63	66	68	59	68	66	67	61	66	66	60	65
1926	61	57	60	65	68	63	60	61	59	63	63	63	62
1927	63	64	60	65	64	61	61	61	61	64	65	62	63
1928	60	62	64	66	67	68	65	62	57	61	63	58	63
1929	58	60	64	61	63	61	63	66	61	63	61	61	62
1930	61	61	61	65	68	59	57	49	48	53	52	48	57
1931	45	49	50	53	56	56	48	45	42	39	41	36	47
1932	42	40	43	45	47	44	42	43	45	44	40	38	43
1933	39	42	47	48	53	54	54	55	50	54	56	58	51
1934	60	63	65	67	66	68	66	63	67	67	65	71	66
1935	73	75	78	78	76	78	76	72	72	74	76	76	75
1936	80	81	82	85	85	81	83	80	84	84	86	88	83
1937	88	92	92	92	94	94	92	90	89	85	83	79	89
1938	80	89	87	88	86	85	83	80	80	78	78	76	83

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

TABLE 47. HORSES: RELATIVE PRICES RECEIVED BY FARMERS, MISSISSIPPI, 1910-1938 (1924-1928 equals 100)

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
1910	192	172	207	207	211	194	192	197	194	194	192	188	195
1911	199	192	199	192	195	180	195	186	188	184	178	178	189
1912	167	164	172	175	188	184	188	181	183	191	188	181	180
1913	181	188	191	181	189	192	194	199	189	188	173	181	188
1914	186	188	192	191	188	188	189	197	181	170	169	162	183
1915	166	164	177	173	173	169	172	164	167	175	166	169	147
1916	167	172	178	173	173	173	175	170	158	164	158	158	169
1917	164	169	169	172	173	167	180	178	181	178	181	197	177
1918	191	192	210	211	205	202	199	200	199	197	199	205	200
1919	195	199	210	205	214	205	210	207	205	205	192	177	202
1920	210	203	203	213	195	199	207	191	183	169	142	139	188
1921	131	126	126	126	128	121	120	118	126	115	110	115	121
1922	114	98	109	118	117	118	120	118	118	114	118	110	115
1923	106	104	110	97	115	121	118	114	110	112	101	101	110
1924	99	101	101	99	101	106	104	110	106	101	106	101	101
1925	101	99	104	107	93	107	104	106	96	104	104	95	101
1926	96	90	95	101	107	99	95	96	93	99	99	99	98
1927	99	101	95	101	101	96	96	96	96	101	101	98	99
1928	95	98	101	104	106	107	101	98	90	96	99	91	99
1929	91	95	101	96	99	96	99	104	96	99	96	96	98
1930	96	96	96	101	107	93	90	77	76	84	82	76	90
1931	71	77	79	84	88	88	76	71	66	61	65	57	74
1932	66	63	68	71	74	69	66	68	71	69	63	60	68
1933	61	66	74	76	84	85	85	87	79	85	88	91	80
1934	95	99	101	106	107	107	104	99	106	106	101	112	104
1935	115	118	123	123	120	123	120	114	114	117	120	120	118
1936	126	128	129	134	134	128	131	126	132	132	136	139	131
1937	139	145	145	145	148	148	145	142	140	134	131	125	140
1938	126	140	137	139	136	134	131	126	126	123	123	120	131

TABLE 48. MULES: AVERAGE PRICE PER HEAD RECEIVED BY FARMERS, MISSISSIPPI, 1926-1938

Year	Jan. 15	Feb. 15	Mar. 15	April 15	May 15	June 15	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Year
	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.	Dol.
1926	92	93	99	104	100	98	91	91	89	94	92	89	94
1927	86	86	87	99	93	92	90	92	98	93	95	94	92
1928	88	95	99	104	102	103	100	100	98	98	96	96	98
1929	96	96	100	105	105	100	98	98	99	103	103	100	100
1930	102	102	102	103	104	97	93	75	78	80	75	70	90
1931	71	75	80	83	83	84	75	70	65	63	65	61	73
1932	60	60	66	72	70	68	65	67	66	62	57	58	64
1933	59	64	68	73	78	80	82	82	77	79	84	88	76
1934	92	97	100	100	99	97	97	94	95	98	98	103	98
1935	108	115	118	117	117	117	112	110	107	109	113	114	113
1936	120	125	130	130	127	124	125	120	122	125	127	130	125
1937	133	135	137	137	140	138	134	130	130	126	122	120	132
1938	122	131	128	128	127	125	124	117	117	115	112	114	122

Data compiled from United States Department of Agriculture, Statistical Bulletin No. 16, and monthly issues of crops and markets.

Bulletin No. 333 July, 1939

Fertilizer Response and Requirements For Profitable Crop Production In the Yazoo-Mississippi Delta

By ROY KUYKENDALL, Agronomist
Delta Branch Experiment Station
Stoneville, Miss.

Mississippi Agricultural Experiment Station
CLARENCE DORMAN, Director
State College, Mississippi

Summary

The soil fertility experiments throughout the Yazoo-Mississippi Delta tend to indicate that:

1. Soils on the west side of the Delta respond to nitrogen only.

2. Most soils on the east side respond to nitrogen, potash, and phosphorus.

3. The most practical rate of applying nitrogen is 30 to 40 pounds per acre.

4. Ordinarily, the nitrogen can be applied on heavy soils from late fall to three weeks prior to planting, and on lighter soils any time in the spring up to 10 days before planting with very little difference in yields of seed cotton and corn, and any time from fall to March 15 for oats.

5. Little difference is obtained from the various placements so long as they are mixed in the seed bed, if applied before planting.

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Fertilizer Response and Requirements For Profitable Crop Production In the Yazoo-Mississippi Delta

By ROY KUYKENDALL, Agronomist
Delta Branch Experiment Station
Stoneville, Miss.

High yields are necessary if crops are to be produced profitably, and high yields are produced on fertile soils. Nitrogen availability is probably the most important controllable fertility factor in the eastern Cotton Belt, but is even more important in the Yazoo-Mississippi Delta. On a majority of Delta soils, a sufficient amount of available nitrogen represents the difference between a profitable and unprofitable crop yield.

Until 1913, periodic overflows tended to maintain soil fertility on a large portion of the Delta, and the addition of plant food was not practiced. Less frequent overflows during the past quarter-century, and 25 to 100 years of continuous cropping have reduced the nitrogen and other plant food. While it is difficult to build up the organic content and the nitrogen supply in soils, normal amounts of each as needed in crop production can be obtained by proper farm practices. This has been demonstrated by our experiments and by large increases in the average cotton yields under the Government farm program.

The Yazoo-Mississippi Delta is a lens shaped body of land about 185 miles long and about 68 miles in width at the broadest point. It embraces some four and one-half million acres, of which 40% are still in wood land. It is the largest body of fertile land in the state and one of the largest in the United States. It is practically level and free from erosion.

Three Soils in Delta

Soil fertility experiments, begun at the Delta Branch Experiment Station in 1921, indicated that most Delta soils are deficient in nitrogen, and some of them in phosphorus and potash also. Recent work shows that so far as fertilizer requirements for profitable crop yields are concerned, the Yazoo-Mississippi Delta may be divided into at least three areas.

The alluvium on the west side was formed primarily from contributions by the Mississippi River and carries a sufficient amount of lime, phosphorus and potash, but a deficiency of nitrogen. Soils on the east side of the Delta have been influenced by later contributions from outwash and the overflow of streams arising in the adjacent hills. Investigations in this area indicate a distinct deficiency of lime and nitrogen, a distinct to a slight deficiency of potash and of phosphorus in localized areas.

The intervening soil types between these two areas were probably built up from mixtures of the overflow of the Mississippi River and of streams arising in the adjacent hills, and show a distinct deficiency of lime and nitrogen and a deficiency of potash and phosphorus. In this area, responses to potash and phosphorus are erratic and not as consistent as in the case of nitrogen.

Since the Experiment Station can not make tests on all farms and plantations, it is apparent that planters in the east half of the Delta should proceed on an experimental basis to determine whether or not phosphorus or potash may be profitably used on their particular soils.

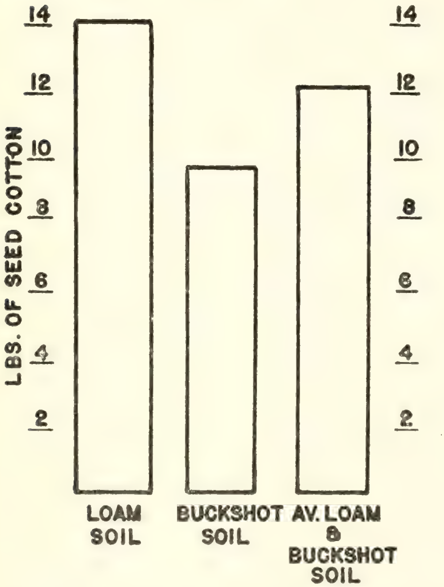
Experimental field trials indicate that the much needed nitrogen can be supplied to Delta soils economically by commercial nitrogenous fertilizers or with summer or winter legume crops.

Fertilizers for the Delta should be considered from the following angles: (1) what kind of fertilizers to use, (2) how much to use, (3) when to apply, and (4) how to apply.

What Kinds of Fertilizer to Use in Delta Area?

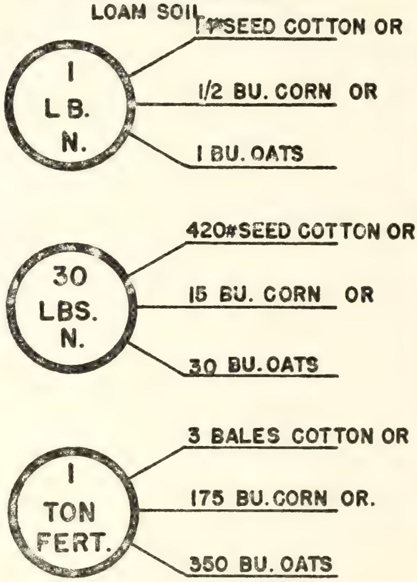
On the west side of the Delta, experimental results indicate that nitrogenous fertilizers are the only kind to use on most soils for profitable crop yields. Experiments extending over a period of 18 years show that a pound of commercial nitrogen produces approximately 14 pounds of seed cotton on loam soil and about 10 pounds on buckshot soil, or an average of 12 pounds for the two soil types. The results of these tests are shown graphically in Figure 1.

INCREASE IN COTTON YIELDS DUE TO THE USE OF ONE LB. OF NITROGEN



These results also show that one pound of nitrogen produces an extra one-half bushel of corn or one bushel of oats. Using these same results, 30 pounds of nitrogen, which is equivalent to 188 pounds of sodium nitrate, 188 pounds of calnitro, 146 pounds of ammonium sulphate, or 136 pounds of cyanamid, produces approximately 420 pounds of seed cotton, or 15 bushels of corn, or 30 bushels of oats on loam soil. Calculating from these data then, one ton of nitrogenous fertilizers produces an extra three bales of cotton, or 175 bushels of corn, or 350 bushels of oats, assuming an average of 350 pounds of nitrogen per ton. These data are shown in Fig. 2.

INCREASED YIELDS DUE TO COMMERCIAL NITROGEN

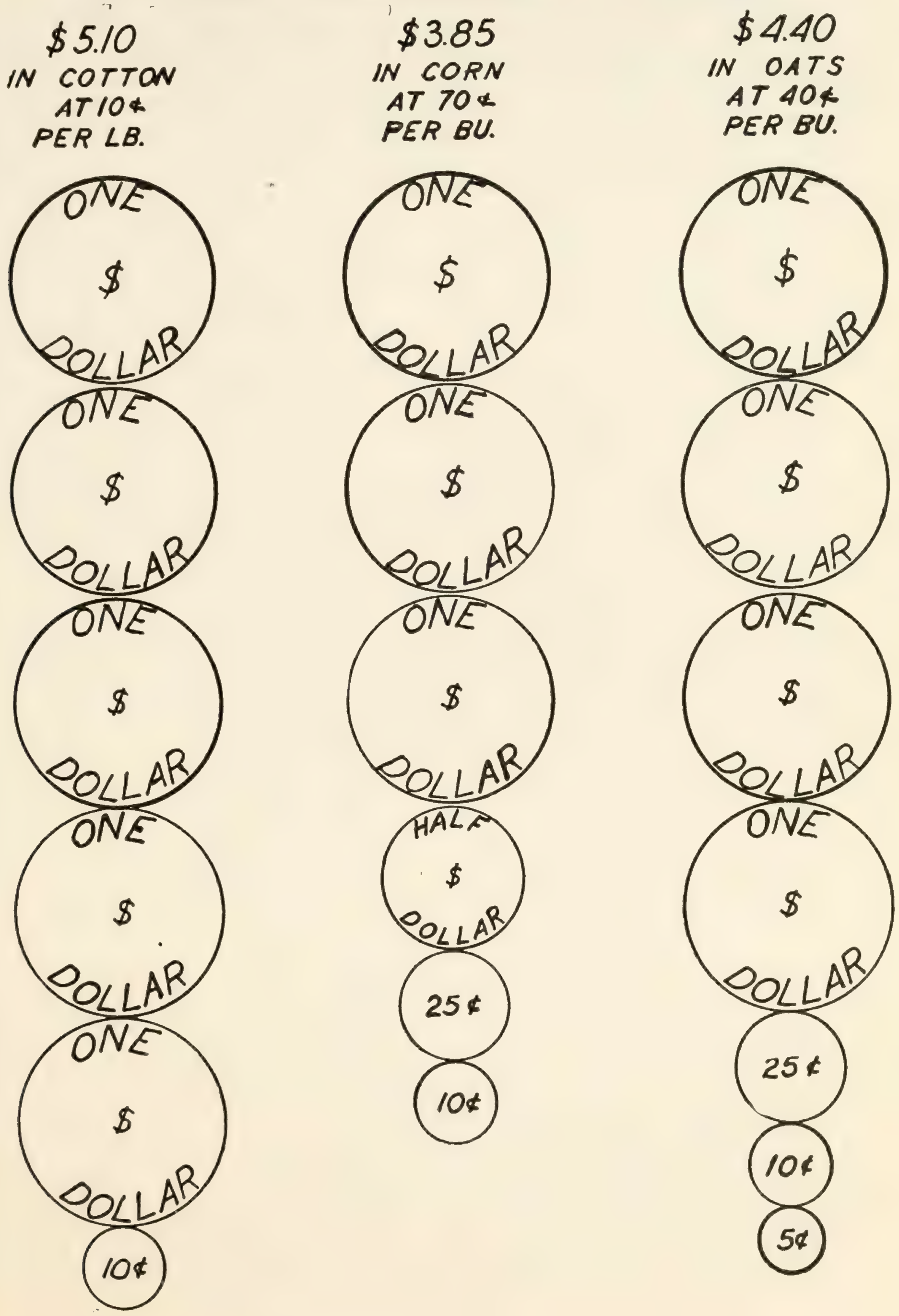


USED AV. 350 LBS. NITROGEN IN TON OF FERTILIZER

This increased yield, due to a ton of nitrogenous fertilizers, probably represents the lowest cost part of the crop so produced. At current nitrogen prices, the increased yields are produced at a cost of approximately 2c per pound for lint exclusive of picking and ginning, 18c per bushel of corn, and 9c per bushel of oats.

Using 1939 prices for fertilizers, these results indicate that $1.00 spent for nitrogenous fertilizers returns $5.10 worth of lint cotton at 10c per pound, $4.40

One Dollar Spent for Nitrogen Fertilizer (11 Pounds Nitrogen) Increases Crop Returns:

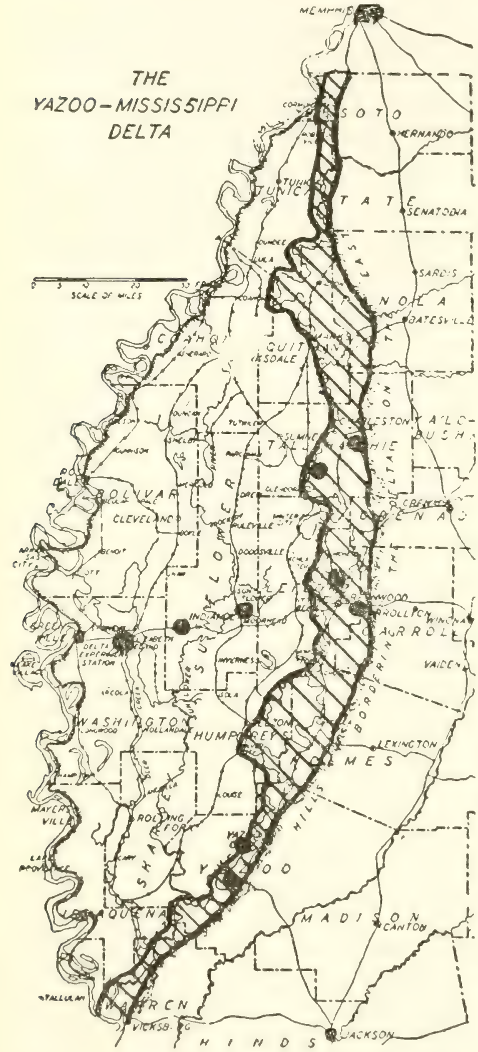

$5.10 IN COTTON AT 10¢ PER LB.
$3.85 IN CORN AT 70¢ PER BU.
$4.40 IN OATS AT 40¢ PER BU.
ONE $ DOLLAR
HALF $ DOLLAR
25¢
10¢
5¢

worth of oats at 40c per bushel, or $3.85 worth of corn at 70c per bushel. These values are shown in Fig. 3. (Page 5).

As already stated, on the extreme East Delta and in the Coldwater-Tallahatchie-Yazoo River basin, crops respond to phosphorus and potash in addition to nitrogen. Since there has been no recent soil survey made in the Delta, it is difficult to determine the boundary lines between these soil areas.

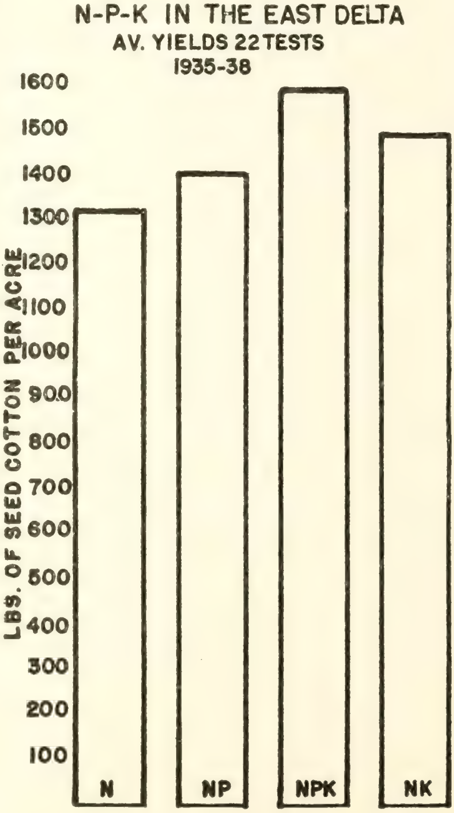
Experimental results indicate that nitrogen increases cotton yields, on an average, 200 to 500 pounds of seed cotton per acre; and where needed, phosphorus 60 to 170 pounds and potash 100 to 300 pounds per acre.

An average of 22 tests over a period of four years shows increases of 99, 162, and 250 pounds of seed cotton per acre for phosphorus, for potash, and for potash and phosphorus combined, respectively. These data are summarized graphically in Figure 4.


THE
YAZOO-MISSISSIPPI
DELTA
SCALE OF MILES
MEMPHIS
SOTO
HERNANDO
TUNICA
TATE
SENATOBIA
SARDIS
NOLA
BATESVILLE
COAHOMA
QUITMAN
TALLAHATCHIE
BOLIVAR
CLEVELAND
SUNFLOWER
LEFLORE
CARROLL
WASHINGTON
HUMPHREYS
HOLMES
LEXINGTON
SHARKEY
YAZOO
ISSAQUENA
MADISON
CANTON
WARREN
VICKSBURG
HINDS
JACKSON
DELTA EXPERIMENT STATION
HILLS

The shaded area represents the East Delta Area.

The black circles represent experimental fields.



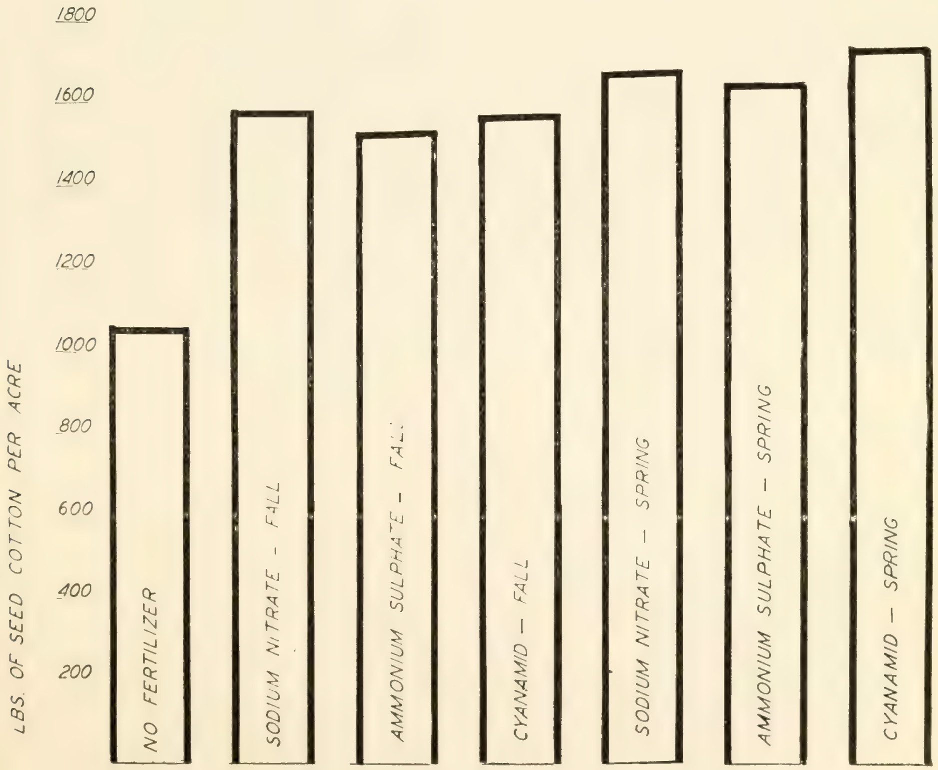
When to Apply Fertilizer --Spring or Fall?

The next question is, "When to apply nitrogenous fertilizers in the Delta?" Since 16-year average results show that but slightly better yields were obtained by side-dressing cotton or corn, the safest, most satisfactory and economical time to apply in the Delta is before planting.

As there was very little difference in cotton yields from applications of fertilizers applied any time between February 1 and planting time, the Delta Station conducted an experiment using [illegible] urces of nitrogen applied in the fall and in the spring on cotton, corn, and oats.

Eight years' work indicates that March 15 is the best date to apply nitrogen to oats in the spring, but a two-year average on the present experiment shows better yields for the three sources when applied in the fall. On corn, spring applications of the three sources produced three to six bushels more corn per acre than fall applications. Spring applications made slightly more cotton than fall applications with the same three sources of nitrogen. However, increases of more than 400 pounds of seed cotton per acre were obtained from fall applications.

Figure 8 shows graphically the two-year average yields for cotton.



How Much Fertilizer For Most Profitable Crop Production?

After the question of what kind of fertilizer to use is settled, the next question is, "How much to apply?" Data from 18 years of experimental work varying nitrogen in 7½-pound increments from 0 to 45 pounds per acre, using sodium nitrate as the source, shows that profitable increases are received from all applications up to 37½ pounds of nitrogen per acre on cotton and corn, and 11 years' work shows the same results for oats. These data apply to cotton, oats, and corn in a 3-year rotation. Average yields for cotton are shown in Figure 5.

The average yield of corn from rates-of-applying-nitrogen test for an 18-year period, 1920 to 1938, are presented graphically in Figure 6.

Figure 7 shows an 11-year average yield for different rates of applying nitrogen to oats.

These results indicate that oats respond to nitrogen more readily than cotton or corn. Thirty pounds of nitrogen on soils that have not had a legume crop turned under recently have approximately doubled oat yields.

STEPPING UP TO HIGH COTTON YIELDS

Rates of Applying Nitrogen for Cotton 18 Years Average 1921-1938

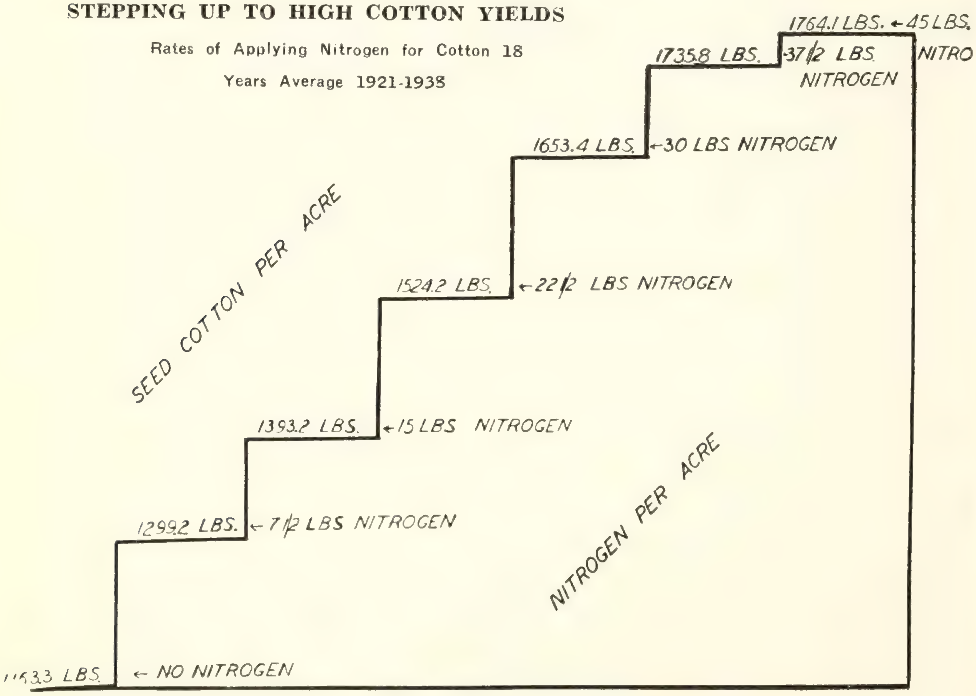
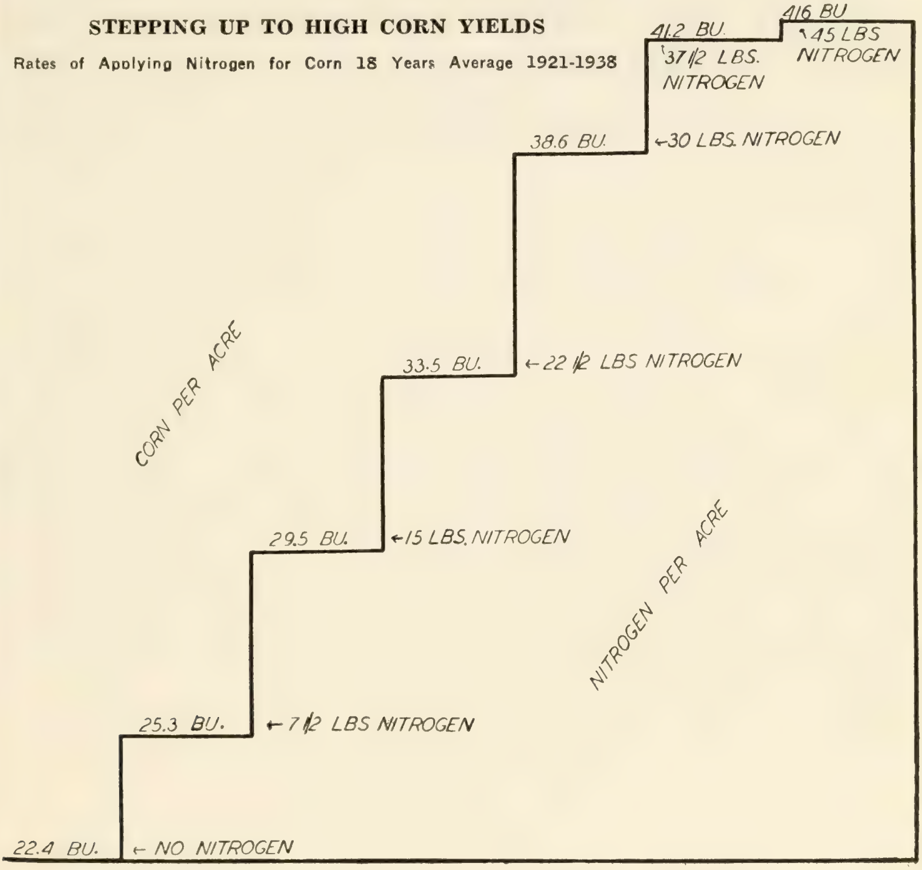


Table 5, above, shows average annual results of 18 years' work on rates of applying nitrogen for cotton. Every increase in the quantity of nitrogen applied resulted in increased cotton yield. The average annual yield of the unfertilized check plat was 1163.3 pounds seed cotton. When 7½ pounds nitrogen was applied, the yield was 1299.2 pounds. The application of additional nitrogen in 7½ pound increments resulted in yields of seed cotton per acre as follows: 15 pounds nitrogen, 1393.2 pounds seed cotton; 22½ pounds nitrogen, 1524.2 pounds seed cotton; 30 pounds nitrogen, 1653.4 pounds seed cotton. Rates of application higher than 30 pounds per acre yielded less profitable returns.

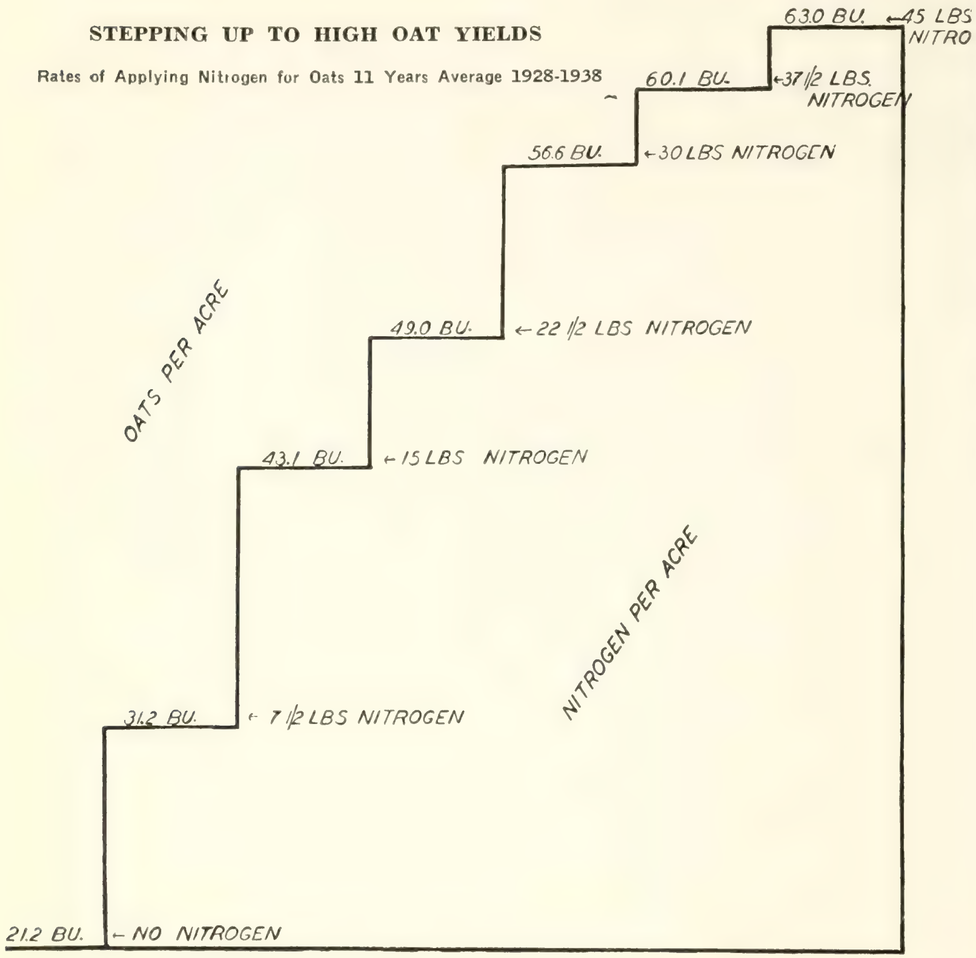


STEPPING UP TO HIGH CORN YIELDS

Rates of Applying Nitrogen for Corn 18 Years Average 1921-1938

Table 6, above, shows average annual results of 18 years' work on rates of applying nitrogen for corn. From the yield of 22.4 bushels per acre from unfertilized check plat, the application of commercial nitrogen at the rate of 7½ pounds per acre increased the yield to 25.3 bushels. Increased application of nitrogen, in 7½ pound increments, gave the following results: 15 pounds nitrogen, 29.5 bushels; 22½ pounds nitrogen, 33.5 bushels; 30 pounds nitrogen, 38.6 bushels. Further increase in nitrogen application gave increased yields but diminished returns.

Thirty pounds nitrogen is derived from the following amounts of indicated materials: sodium nitrate, 188 pounds; calcium nitrate, 200 pounds; calnitro, 188 pounds; ammonium nitrate, 167 pounds; ammonium sulphate, 146 pounds; granular cyanamid, 143 pounds; pulverized cyanamid, 136 pounds; cottonseed meal, 460 pounds.



STEPPING UP TO HIGH OAT YIELDS

Rates of Applying Nitrogen for Oats 11 Years Average 1928-1938

Table 7, above, shows annual results of 11 years' work on rates of applying nitrogen for oats. As in the instances of similar experiment with cotton and corn every increase in the quality of nitrogen applied resulted in increased oat yields. Differing somewhat from the cotton and corn experiments however, was the fact that more profitable yields were secured from the 7½ pound and 15 pound applications of nitrogen for oats. The application of 7½ pounds nitrogen increased the yield of the unfertilized plat by nearly 50 per cent, and applications of 15 pounds nitrogen more than doubled the yield of the unfertilized plat. Profitable returns were had from higher applications ofnitrogen, especially the use of 30 pounds of nitrogen per acre. Average annual yields were as follows: no nitrogen, 21.2 bushels per acre; 15 pounds nitrogen, 43.1 bushels per acre; 30 pounds nitrogen, 56.6 bushels per acre; 45 pounds nitrogen, 63 bushels per acre.

Most Economical and Practical Placement of Fertilizer

From 1929 to 1937, experiments were conducted to determine the most practical and economical placement of nitrogenous fertilizers in connection with seed bed preparation for cotton production. Calcium nitrate and cyanamid were used in this experiment. These tests indicated that there was very little difference in yields from the various placements of the two fertilizers so long as they were mixed in the seed bed prior to planting time. A very good method of applying fertilizer is to drill or broadcast it and bed or rebed on it any time within two weeks of planting.

Data covering the placement work from 1929 to 1936 are shown in detail in the following table:

SEED COTTON YIELDS PER ACRE FROM VARIOUS PLACEMENTS OF CALCIUM CYANAMID AND CALCIUM NITRATE—DELTA EXPERIMENT STATION—1929-1936

Placements	1929	1930	1931	1932	1933	1934	1935	1936	8-Year Average 1929-36
				Calcium Cyanamid					
On bed—disk in	1864.1	899.1	972.3	706.2	1531.8	969.0	1004.7	1065.0	1126.5
In buster furrow	1859.2	874.2	1025.1	762.7	1528.4	952.5	934.7	1018.7	1119.4
In shovel furrow) In buster furrow)	1860.9	925.6	996.7	692.2	1638.0	1025.6	961.7	1054.8	1144.4
On the list	1873.9	776.4	1036.6	705.4	1500.4	954.3	936.0	1065.3	1106.0
Broadcast on beds	1829.9	939.6	938.6	706.4	1668.4	1050.3	993.6	1065.6	1149.1
Broadcast before rebedding	1784.9	672.7	1007.5	778.6	1601.7	1011.3	1035.7	1141.5	1129.2
In furrow on beds	1809.1	731.3	1021.0	729.7	1475.4	1006.3	998.4	1149.3	1115.1
				Calcium Nitrate					
On bed—disk in	1807.6	1004.0	1017.6	783.6	1353.9	877.2	849.3	973.5	1083.3
In buster furrow	1837.7	1164.6	1175.1	880.0	1389.8	881.5	871.4	988.5	1148.6
In buster furrow)	1796.6	1173.3	1147.8	854.0	1454.3	1000.6	951.4	1030.0	1176.0
On the list	1788.1	1035.4	1115.7	816.9	1386.8	963.7	949.1	1016.9	1134.1
Broadcast on beds	1843.8	781.4	969.3	769.3	1382.3	886.5	738.9	905.8	1034.7
Broadcast before rebedding	1720.0	779.9	1073.8	840.0	1284.5	820.5	663.4	943.8	1015.7
In furrow on beds	1698.2	847.3	1099.0	828.1	1292.8	827.1	656.8	983.9	1029.2

Seed Cotton Yields

Seven methods of placement extending over a period of eight years show little choice between methods used for applying cyanamid and only a small increase in yield for the deep application of calcium nitrate. Although crop yields fluctuate greatly from year to year because of seasons, yields from all placements were reasonably close together whether the season was conducive to high, medium, or low yields.

Bulletin No. 334 **September, 1939**

SMALL GRAIN PRODUCTION

In the Yazoo-Mississippi Delta

FIGURE 1—EXPERIMENTAL PLATS IN THE FERTILIZER EXPERIMENTS

By **ROY KUYKENDALL**, Agronomist
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Stoneville, Miss.

Mississippi Agricultural Experiment Station

CLARENCE DORMAN, Director

State College, Mississippi

Summary and Conclusions

The results of 19 years of experimental work with small grains at the Delta Branch Experiment Station, consisting of variety comparisons, rates and dates of seeding oats, sources of nitrogen, rates and dates of applying nitrogen to oats and comparison of corn and oat production, may be summarized as follows:

1. The highest yielding oat varieties in the tests were the Red Rust Proof strains including Ferguson 922, Nortex, Delta Station selection, Hastings' 100 Bushel, Appler, and Baylis. Among the earlier varieties, Coker's Fulgrain Fulghum, and Kanota have given best yields.
2. October 15 was the best date to sow oats for maximum yields.
3. From 9 to 12 pecks per acre was the best rate to seed oats for maximum yields.
4. Thirty pounds of nitrogen per acre from most all the commercial sources of nitrogen more than doubled the yields of oats planted in the fall on Sarpy loam soil of low fertility over an average of 12 years.
5. For an average of 12 years, Sodium Nitrate produced slightly higher yields than the other sources of nitrogen used.
6. In the Rates of Application experiment, the most economical yield of oats was produced from 30 pounds of nitrogen.
7. March 15 was indicated as the best time to apply nitrogen, from Sodium Nitrate, to produce maximum yields on fall seeded oats.
8. Sodium Nitrate and Ammonium Sulphate produced slightly better yields when applied in March, but Cyanamid produced better yields when applied in November.
9. Higher yields in pounds of grain per acre were secured from corn than from oats when the two crops were not fertilized; but when both were fertilized, the oats yielded nearly as many pounds of grain per acre.

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SMALL GRAIN PRODUCTION

In the Yazoo-Mississippi Delta

By **ROY KUYKENDALL**, Agronomist
Delta Branch Experiment Station, Stoneville, Mississippi

The production of oats is of increasing importance in Mississippi, and though oats may not yet be considered as a major agricultural crop in the state the trend seems definitely in that direction.

The total acreage seeded to oats during the ten-year period 1928-1937, according to Crops and Markets, published monthly by the United States Department of Agriculture, was 43,000 acres. According to the same authority, the acreage seeded to oats in Mississippi in 1938 was 59,000 acres and in 1939, 66,000 acres. Average annual production for the ten-year period 1928-1937, was 918,000 bushels. In 1938 the total yield was 1,593,000 bushels, while the yield indicated July 1, 1939 was 2,046,000 bushels. These figures indicate an increase of more than 50 per cent in acreage and an increase of more than 100 per cent in yield in 1939 as compared with the stated ten-year period.

Other small grains have been produced to a minimum extent only, though some increase has been noted in recent years.

Oats have been produced on Mississippi farms since pioneer days, but in the main as a source of feed for workstock on the farm where produced. The agricultural census of 1935 shows that during the crop year 1934, the total of 12,620 acres of oats was threshed for grain and 31,666 acres was cut and fed unthreshed. More recently, however, and especially in the delta area, oats have developed into a cash crop for sale as grain or as seed.

The average per acre yield of oats in Mississippi has been too low for profitable production, being only 21.4 bushels per acre during the period 1928-1937. The fact that average yields have been increased during recent years—to 27 bushels per acre in 1938 and to 31 bushels per acre in 1939—indicates that farmers in all sections of the state are applying improved farm practices in oat production.

Studies conducted by the Delta Branch Experiment Station in conjunction with similar studies conducted by the Mississippi Experiment Station at State College indicate that further progress may be made. These studies show that under normal climatic conditions, delta soils produce profitable oat yields. High yielding and adapted varieties, planted in the fall at the rate of 10 to 12 pecks of seed per acre and fertilized with 30 pounds of commercial nitrogen, produce an average of approximately 60 bushels of oats per acre.

The small grain work of the Delta Branch Station has been continued since it was begun in 1921, and has been greatly extended during recent years. The purpose of this work was to determine preferred farm procedure on major factors entering into oat production and production of other small grains. The investigations have, therefore, consisted of the following experiments:

1. Oat variety comparisons.
2. Small grain comparisons.
3. Dates of seeding oats.
4. Rates of seeding oats.
5. Fertilizers for oats.

It is the purpose of this bulletin to summarize the small grain work conducted by the Delta Branch Station since 1921 and to interpret the results of the experimental work with respect to the fundamental factors in oat production.

Oat Variety Comparisons Show Value of Red-Rust-Resistant Strains

Each year since 1921 the Delta Branch Station has obtained planting seed of several of the leading varieties of oats on the market and some of the more promising new strains. These were planted in variety tests for the purpose of yield comparisons. The tests were not conducted on the same soil every year but most of them were on Sharkey loam soil. The oats were seeded in the fall except where comparisons were made of fall seedings and spring seedings. The same varieties were not used every year because of the year-by-year elimination of unsuitable varieties with the result that during recent years most of the older varieties have been replaced by newer strains. Table 1 presents the results of this work.

It will be noted that Red Rust Proof varieties, such as Nortex, Delta Station Strain, Ferguson, Hastings 100 bushel, Appler, and Bayliss usually produced higher yields than other varieties; and that Fulgrain outyielded other non-red-rust-resistant varieties. The Red-Rust Proof strains winter killed only one year.

For the purpose of more direct comparison, the yields of identical varieties obtained from different seed sources were combined in such a way as to show the yearly and average yields of those varieties for the greatest number of years during which direct comparisons were possible. This information is shown in table 2.

TABLE II—AVERAGE YIELDS OF VARIOUS VARIETIES OF OATS FOR THE PERIOD OF 1921-39*

Bushels per Acre

Variety	13 Yrs. 1925-26 1929-39	12 Yrs. 1921-23 1925-26 1933-39	11 Yrs 1921-23 1925-26 1934-39	8 Yrs 1929-36	10 Yrs 1929-32 1934-39	4 Yrs. 1921-23 1925	3 Yrs. 1923 1925-26	6 Yrs. 1934-39	4 Yrs. 1936-39	2 Yrs. 1938-39
Fulghum	47.3	44.5	46.0	40.4	45.1	39.8	50.7	46.4	48.9	49.5
Ferguson 922	60.7	61.4	62.0	53.3	60.3	50.5	53.7	67.0	68.4	80.3
Kanota	39.2	......	......	30.4	35.2	......	......	38.1	42.4	41.5
Hastings' 100 Bu.		60.6	60.6	......	......	50.3	57.7	65.2	66.8	76.2
Appler			60.6	......	......	50.3	50.7	65.2	66.8	76.2
Norton			.....	39.8						
Baylis			......	......	56.3	......	......	64.1	68.9	80.2
Texas R. R. P.							45.3	......	......	......
Dwarf Culberson						29.3	......	......	......	......
Navarro							54.0	......	......	......
Nortex								72.7	76.0	84.6
Fulgrain									60.1	56.2
Delta Station R. R. P.									72.3	81.6
Commercial R. R. P.										76.4
Terruf										77.2

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*The Fulghum average yields were obtained from combinations of Coker's Fulghums in 1921, Fulghum 106 in 1922-23, Fulghum 4 in 1933 and commercial Fulghums from the Fidelity Seed Company in 1934-36, and Fulghum from T. W. Wood and Sons in 1937-39. The Ferguson 922 average yields were obtained by combining Ferguson 71 with it wherever necessary. The TexasRed Rust Proof average yields were obtained from combinations of yields obtained from seed secured from Goyer Wholesale Company 1922-23, Ferguson Seed Company 1925, 1931-32, and selection from this Station in 1926. 1924 is not included in any average.

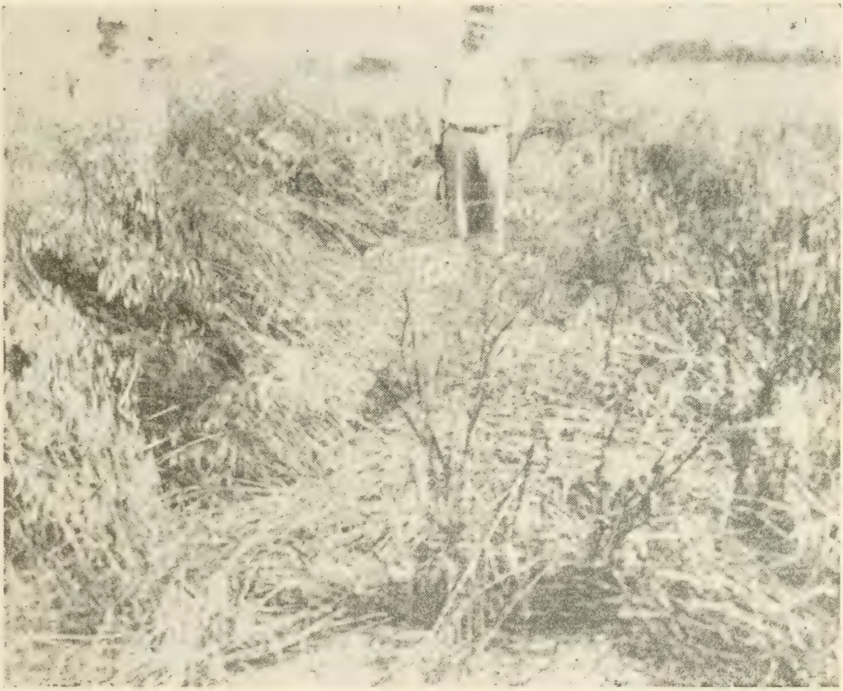

FIGURE 2—Oats showing extreme lodging from the use of too much nitrogen.

The results of 19 years work in variety testing indicate that the Red Rust Proof strains of oats have produced highest yields. Two varieties have been continued throughout this period and during 16 of these years, 1921-25, 1929-39, one of these, Ferguson 922, has yielded annually 58.5 bushels per acre However, data from recent years show that seed of the newer strains have produced higher yields. During the two-year period, 1938-39, average annual yields were as follows: Ferguson 922, 80.3 bushels; Nortex, 84.6 bushels; Delta Station Red Rust Proof, 81.6 bushels; Bayliss, 80.2 bushels. Closely following in annual yields were Hastings 100 Bushel, Appler and Terruf. These last named varieties are about ten days later maturing than Fulgrain, Fulgham and Kanota. Yield records indicate that at present Fulgrain is the best early oat variety under the conditions of the work of the Delta Branch Station.

The consistent performance of the Red Rust Proof strains throughout the 21-year period seems sufficient evidence of their superiority for grain production. It often occurs, however, that oats of a different maturity date are desired in order that the harvesting period may be extended. Of the earlier, non-red-rust-resistant varieties to be planted for this purpose, Fulgrain or Fulgham is recommended. Many planters seed 70 per cent of their oat acreage to Red Rust Proof strains, and 30 per cent to Fulgrain or Fulgham, in order to begin combining ten days earlier than would be possible were only the Red Rust Proof strains planted.

Small Grain Variety Comparisons: Rye, Wheat And Barley Produce Well

Minimum quantities of wheat, barley, and rye have been grown in the Yazoo-Mississippi delta for grain production, though the acreage of barley has considerably increased during the past two years. Because of this interest, and for the purpose of determining yields that might be expected in this area under conditions of good farming practices, the Delta Branch Station has recently expanded its experiments begun in 1928 to determine probable yields of these small grains. The comparisons were made most years on Sharkey loam soil, and the grains were seeded in the fall. Results of this work are shown in tables 3 and 4.

TABLE III—ANNUAL YIELDS FROM WHEAT, BARLEY AND RYE FROM 1928 TO 1939

Grain and Variety	Bushels per Acre										
	1928	1929	1931	1932	1933	1934	1935	1936	1937	1938	1939
Bearded Barley	18.0	11.6	40.4	20.7	16.8	28.7	20.5	28.2	36.9	31.0	......
Fulcaster Wheat	25.7	4.9	28.3	11.0	24.5	16.2	6.9	10.9	35.5	18.5	20.6
Red May Wheat	26.7	3.4	33.6	10.0	24.8	11.3	4.3	9.8	31.4	22.2	24.2
Purple Straw Wheat	24.0	5.8	34.0	12.6	26.3	16.5	4.8	15.4	36.7	22.2	34.7
Abruzzi Rye	12.3	7.1	......	10.5	25.8	20.6	33.9	11.8	27.0	44.5	42.8
Beardless Barley	16.4	7.8	......	......	9.4	16.8	21.2	21.0	24.0	29.7	......
Denton Wheat	......	......	33.5	15.9	28.4	13.1	6.4	18.9	33.5	21.6	23.9
Fultz Wheat	......	5.3	28.8	11.5	25.6	16.1	......	14.2	......	......	......
Gasta Wheat	......	......	......	......	26.3	16.5	7.1	20.3	41.6	23.0	31.5
Red Hart Wheat	......	......	......	......	22.0	13.7	2.4	25.5	38.7	23.3	33.8
Texas Winter Barley	......	......	......	......	......	......	......	21.7	46.7	40.1	42.2
Rosen Rye	6.3	6.2	......	......	......	......	......	......	......	......	......
Penn. 44 Wheat	25.3	2.7	......	......	......	......	......	......	......	......	......
Tenn. Winter Barley	......	......	......	......	......	......	......	......	......	32.5	34.2
Early Black Hull Wheat		......	......	......	......	......	......	......	......	20.5	30.6
Tennmarq Wheat	......	......	......	......	......	......	......	......	......	21.9	24.5
Finley Barley	......	......	......	......	......	......	......	......	......	32.7	......
Missouri Winter Barley											23.4
Wintex Barley											48.8
Harlan Hybred Barley											44.7

Fairly good yields of wheat, rye, and barley were harvested throughout the entire period of experimentation. More recently, all small grain yields have considerably increased, and this is thought due in part at least to superior and better adapted varieties.

Purple Straw wheat produced 21.2 bushels per acre over a period of 11 years. It was the highest average yield made during that period with wheat varieties. Gasta, a strain of Purple Straw wheat, produced an average of 23.7 bushels per acre during the past 7 years. It was the highest wheat yield made during that period. During the two most recent years, 1938 and 1939, the highest wheat yields, were made by Red Hart, 28.6 bushels, and Purple Straw, 28.5 bushels, closely followed by Gasta, 27.3 bushels.

Over the 10-year period Abruzzi rye produced an average of 23.6 bushels. During the 7-year period the yield of Abruzzi rye was 29.5 bushels. During the 2-year period 1938-39 the yield of Abruzzi rye was 43.7 bushels.

Varieties of barley not heretofore produced in Mississippi were included in the comparisons during the years 1938 and 1939 and of these, Texas Winter Barley averaged 41.2 bushels per acre

TABLE IV—AVERAGE YIELDS OF WHEAT, BARLEY AND RYE FROM 1928 TO 1939

	Bushels per Acre							
Grain and Variety	11 Yrs. 1928-29 1931-39	10 Yrs. 1928-29 1932-39	7 Yrs. 1928-29 1933-37	9 Yrs. 1931-1939	6 Yrs. 1929-1931-34 1936	7 Yrs. 1933-1939	2 Yrs. 1928-1929	2 Yrs. 1938-1939
Fulcaster Wheat	18.4	17.5	17.3	19.1	16.0	19.0	15.3	19.6
Red May Wheat	18.3	16.8	16.0	19.1	15.5	18.3	15.0	23.2
Purple Straw Wheat	21.2	19.9	18.5	22.6	18.4	22.4	14.9	28.5
Abruzzi rye	......	23.6	19.8	......	......	29.5	9.7	43.7
Beardless Barley	......	......	16.6	......	......	......	12.1	......
Bearded Barley	......	......	23.8	......	24.4	......	14.8	......
Denton Wheat	......	......	......	23.8	......	20.8	......	22.8
Fultz Wheat	......	......	......	......	16.9	......	......	......
Gasta Wheat	......	......	......	......	......	23.7	......	27.3
Red Hart Wheat	......	......	......	......	......	22.8	......	28.6
Rosen Rye	......	......	......	......	......	......	6.3	......
Penn. 44 Wheat	......	......	......	......	......	......	14.0	......
Tenn. Winter Barley	......	......	......	......	......	......	......	33.4
Texas Winter Barley	......	......	......	......	......	......	......	41.2
Early Black Hull Wheat	......	......	......	......	......	......	......	25.6
Tennmarq Wheat	......	......	......	......	......	......	......	23.2

during the 2-year period. During 1939 barley yields were as follows: Texas winter barley, 42..2 bushels; Tennessee barley, 34.2 bushels; Missouri barley, 23.4 bushels; Harland Hybred, 44.7 bushels; Wintex barley, 48.8 bushels

Summarizing results of the more recent period, two-year average (1938-39) yields for rye, barley. and wheat were as follows: Abruzzi rye 43.7 bushels, Texas winter barley 41.2 bushels, Red Hart wheat 28.6 bushels, Purple Straw wheat 28.5 bushels and Gasta wheat 27.3 bushels per acre.

Wheat, barley, and rye are more winter resistant than oats and will probably withstand more grazing. They usually make fewer bushels and not quite so many pounds of grain per acre, but results during the past two years indicate that under favorable circumstances splendid yields may be secured from all small grains in the Yazoo-Mississippi Delta. Since there is a growing interest in livestock for this area, it seems likely that these crops may be increasingly used for grazing and for grain feeding.

Dates of Seeding Oats: Mid-October Indicated As Best Date for Planting

In order to determine the best average date for seeding oats to produce maximum yields, comparisons were made of yields from fall plantings begun on September 15 and continued in 15 day intervals until November 15 and from spring plantings begun on February 15 and continued until April 1. Two varieties of oats, Ferguson 922 and Norton, were used in this experiment. The results of these tests are shown in table 5.

TABLE V—YIELDS FROM VARIOUS DATES OF SEEDING OATS

					Bushels per Acre					
Seeding Dates	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
					Ferguson 922					
October 15	71.6	37.4	79.5	56.2	33.8	51.1	72.2	82.8	87.7	63.6
September 15	81.6	40.3	34.2	60.7	26.1	48.1	55.3	66.3	85.0	55.3
October 1	80.9	41.2	59.1	56.1	29.4	44.5	64.4	67.3	85.4	58.7
November 1	76.4	47.4	80.3	60.7	22.5	24.1	64.2	79.5	78.9	59.3
November 15	85.2	41.9	65.0	70.6	8.6	24.1	64.1	57.9	82.1	55.5
February 15	62.1	0.0	4.7	24.7	0.0	23.2	6.9	12.8	11.1	16.2
March 1	67.5	0.0	0.2	21.8	0.0	24.0	2.0	9.1	11.3	15.1
March 15	48.6	0.0	0.6	15.4	0.0	10.6	1.3	0.0	10.2	9.6
April 1	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	2.7	0.3
					Norton					
October 15		23.9	37.7	55.8						39.1
September 15		20.6	23.9	57.9						34.1
October 1		24.0	34.3	65.3						41.2
November 1		19.7	35.2	69.6						41.5
November 15		19.6	27.8	57.5						35.0
February 15		0.0	0.0	9.2						3.1
March 1		0.0	0.0	12.9						4.3
March 15		0.0	0.0	6.8						2.3
April 1		0.0	0.0	0.0						0.0

The results of these 9 years of work on dates of seeding indicate very definitely that the middle of October is the best time to plant Red Rust Proof oats to obtain highest yields. Oats planted October 15 produced an average of 63.3 bushels per acre, while slightly decreased yields were secured from oats planted either October 1 or November 1, and considerably decreased yields were secured from oats planted September 15 and November 15. Plantings made still later resulted in virtual crop failure. From plantings made February 15 the yield was only 16.2 bushels per acre and from plantings made March 15 the yield was only 9.6 bushels per acre.

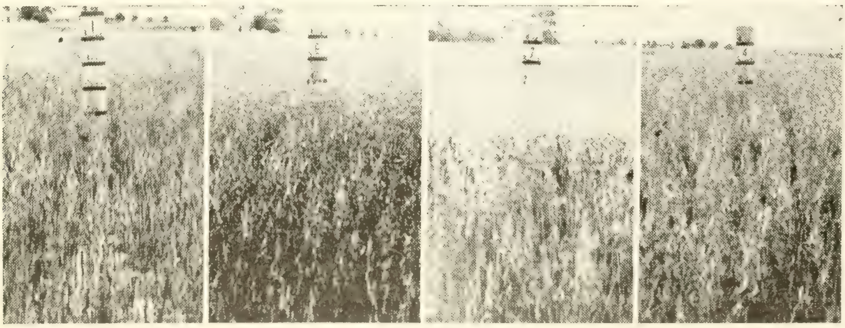

FIGURE 3—Oat plats in the "Sources of Nitrogen" experiment. Left to right: Untreated, Sodium Nitrate, Ammonium Sulphate, and Cyanamid with 12-year average yields of 22.5, 60.9, 52.9, and 46.8 bushels per acre, respectively.

Rates of Seeding Oats: 9 to 12 Pecks Per Acre for Highest Yields

Experimental work on rates of seeding oats was begun at the Delta Branch Station in 1929 and has been continued to date. Under procedure followed, the seeding rates were replicated 4 to 8 times and all factors other than seeding rates were kept as nearly constant as possible. The designated amount of seed for each planting was weighed, placed in separate packages, and broadcast by hand. Most of the experiments were conducted on Sharkey loam soil. Ferguson 922 and Norton varieties were used. Results of these comparisons are shown in table 6.

TABLE VI—YIELDS FROM VARIOUS RATES OF SEEDING FERGUSON 922 AND NORTON OATS

	Bushels per Acre											
No. Pecks per Acre	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
						Ferguson 922						
10 pecks	72.3	57.5	95.3	48.5	52.6	73.9	39.3	60.8	61.3	72.5	79.3	64.8
6 pecks	64.4	61.3	90.8	49.3	49.5	76.9	36.3	59.0	61.3	73.1	78.3	63.2
8 pecks	49.3	58.5	92.7	51.1	48.9	74.0	32.6	60.6	62.1	73.6	79.5	62.1
9 pecks	72.5	57.7	89.8	49.0	52.4	82.0	40.9	60.2	57.4	71.6	78.3	64.7
11 pecks	68.6	53.4	91.4	48.8	48.4	89.4	42.0	58.6	58.3	71.0	78.5	64.4
12 pecks	73.3	56.5	94.8	52.3	48.0	72.5	43.5	55.8	61.6	69.7	76.8	64.1
14 pecks	68.7	58.2	106.9	49.1	52.1	63.6	37.4	58.2	53.8	73.6	77.9	63.6
						Norton						
10 pecks				20.8	30.7	54.1	10.9					29.1
6 pecks				18.1	24.6	62.4	11.0					29.0
8 pecks				19.8	29.3	53.7	9.0					28.0
9 pecks				20.8	29.8	64.9	11.7					31.8
11 pecks				24.8	32.0	54.5	11.3					30.7
12 pecks				22.5	30.3	52.7	11.7					29.3
14 pecks				21.9	33.4	53.8	12.1					30.3

Maximum yields were produced when oats were seeded at the rate of 10 pecks per acre. However, the results show only a slight difference in yield when the quantity of oats planted varied from 1½ to 3½ bushels per acre. With the Ferguson strain the 10 pecks seeding yielded 64.8 bushels, the 8 pecks seeding yielded 62.1 bushels, and the 12 pecks seeding yielded 64.1 bushels. It is likely that these differences are not statistically significant, and from 9 to 12 pecks per acre appears to be the most desirable rates of seeding.

Comparisons to Determine Results from Sources of Nitrogen

Since yields of oats on land of low fertility are so often disappointing, the Delta Branch Station began work with commercial fertilizers with oats in 1928 to determine the most economical source of nitrogen to use, the most economical rate of nitrogen to apply, and the proper time of application for maximum production.

In order to determine which of the sources of commercial nitrogen would produce highest oat yields, a comparison of results from various sources of nitrogen was begun in 1928. This ex-

TABLE 1—ANNUAL YIELDS OF VARIOUS VA

Variety	Seed (a) Source	1921	1922	1923	192
Fulghum 708	1	31.3	49.8	20.4	.....
Fulghum	2	30.1	......	......	83
Dwarf Culberson	1	21.7	28.1	22.7	44
Appler	2	41.0	46.9	......	....
Ferguson 71	3	63.2	56.1	29.3	.....
Hastings' 100 Bushel	4	69.5	52.5	33.7	43.
Fulghum	5	25.8	......	......	.....
Aurora 831	1	19.7	......	......	.....
R. E. No. 1	2	13.2	......	......	.....
Fulghum 106	6	......	47.2	15.7	65.
Appler	6	......	51.1	36.8	54.
R. R. P.—Commerccial	7	......	33.0	27.5	.....
Fulghum Delta	8	......	47.7	......	....
Burt	5	......	......	17.5	43.
Navarro	1	......	......	23.8	62.
Kanota	9	......	......	......	44.
Norton-Station	8	......	......	......	.....
R. R. P.—Delta	8	......	......	......	66.
Ferguson R. R. P.	3	......	......	......	52.
Ferguson 922	3	......	......	......	53.
Baylis	10	......	......	......	.....
Norton	2	......	......	......	.....
Fulghum 3	2	......	......	......	.....
Fulghum 18-1B-4-8	2	......	......	......	.....
7 A1-20-5-3	2	......	......	......	.....
Fulghum 36		......	......	......	.....
Winter Turf	5	......	......	......	.....
Norton 3	2	......	......	......	.....
Black Oats		......	......	......	.....
Fulghum 4		......	......	......	.....
Norton Forage	2	......	......	......	.....
Fulghum—Commercial	11	......	......	......	.....
Nortex	12	......	......	......	....
Ala. R. R. P.	13	......	......	......	.....
Coker 33-50	2	......	......	......	.....
Coker 32-1	2	......	......	......	.....
Coker Fulgrain	2	......	......	......	.....
Coker 33-47	2	......	......	......	.....
Delta Station R. R. P.	8	......	......	......	.....
Fulghum 6A	11	......	......	......	.....
Texas R. R. P.	14	......	......	......	.....
Red Oats	15	......	......	......	.....
Ga. P821 (R. R. P. Str.)	16	......	......	......	.....
Terruf	16	......	......	......	.....
Fulghum x Victoria	17	......	......	......	.....

*All varieties accidentally mixed before they were threshed in 1924. The 1927 overflow ruined t test that year. All varieties but Norton winter killed in Winter of 1927-28 and were replanted in spri but results were lost.

(a) (1) U. S. D. A., (2) Coker's Pedigreed Seed Company, (3) Ferguson Seed Farms, (4) H.

OF OATS FOR THE PERIOD OF 1921-39*

			Bushels per Acre								
926	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......
3.9	......	......	......	......	60.5	78.3	45.7	44.7	70.1	86.2	66.2
......	......	......	......	......	......	......	......	......	57.2	56.7	42.3
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......
70.2	36.6	48.2	77.9	10.5	......	......	......	......	......	......	......
6.3	25.3	......	......	......	......	72.6	48.3	47.2	65.1	84.7	67.7
......	......	......	......	......	......	......	......	......	......	84.9	67.8
......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......
6.1	......	......	......	......	......	......	......	......	......	......	......
3.4	24.5	37.7	52.3	8.6	29.7	44.2	14.7	30.4	56.3	44.9	38.0
......	......	......	79.2	7.4	27.0	64.5	14.5	43.7	......	......	......
6.0	......	......	......	......	......	......	......	......	......	......	......
......	......	......	95.1	37.4	......	......	......	......	......	......	......
8.4	40.9	43.4	76.8	39.1	39.0	83.9	39.6	47.3	70.3	91.1	69.4
......	42.5	38.4	75.5	38.0	......	69.0	40.0	43.4	71.7	88.3	72.0
......	41.5	39.9	......	......	......	......	......	......	......	......	......
......	20.1	......	71.1	12.0	......	......	......	......	......	......	......
......	24.2	......	......	......	......	......	......	......	......	......	......
......	32.8	......	......	......	......	......	......	......	......	......	......
......	......	......	54.2	......	......	......	......	......	......	......	......
......	......	......	38.3	......	......	......	......	......	......	......	......
......	......	......	77.1	......	33.5	67.2	......	......	......	......	......
......	......	......	......	19.3	......	......	......	......	......	......	......
......	......	......	......	......	28.3	......	......	......	......	......	......
......	......	......	......	......	19.8	......	......	......	......	......	......
......	......	......	......	......	......	65.4	17.3	39.4	......	......	......
......	......	......	......	......	......	81.2	50.6	65.3	69.7	92.8	76.3
......	......	......	......	......	......	......	......	49.3	74.1	......	......
......	......	......	......	......	......	......	20.2	43.3	......	......	......
......	......	......	......	......	......	......	10.4	29.1	......	......	......
......	......	......	......	......	......	......	......	59.0	68.7	55.4	57.2
......	......	......	......	......	......	......	......	46.6	......	......	......
......	......	......	......	......	......	......	......	52.0	73.9	93.4	69.8
......	......	......	......	......	......	......	......	37.7	......	......	......
......	......	......	......	......	......	......	......	42.8	......	......	......
......	......	......	......	......	......	......	......	......	71.1	......	......
......	......	......	......	......	......	......	......	......	69.3	......	......
......	......	......	......	......	......	......	......	......	......	80.8	73.5
......	......	......	......	......	......	......	......	......	......	......	60.2

stings' Seed Company, (5) T. W. Wood & Sons, (6) Humphrey Coker, (7) Goyer Company, (8) Delta
periment Station, (9) Kansas Experiment Station, (10) King B Seed Farms, (11) Fidelity Seed
mpany, (12) Texas Experiment Station, (13) Alabama Experiment Station, (14) Buchanan Seed
mpany, (15) L. P. Cook, (16) Georgia Experiment Station, (17) Texas Substation No. 6. Others unknown.

periment was conducted in connection with a three-year rotation using cotton, oats, and corn. All plantings were fertilized in the same manner and oats were planted on the same plats every third year. Thirty pounds of nitrogen per acre was used from each source, which necessitated that the amount of fertilizer from each source vary in respect to its nitrogen content. Oats were seeded cross-wise in all plats and the fertilizer was weighed separately and applied by hand in the spring. The experiment was conducted on Sarpy loam soil. Ferguson 922 and its strains were used every year except 1932 and 1933 when Norton was planted. All factors other than the source of nitrogen were kept as nearly constant as possible. Results are presented in table 7.

TABLE VII—YIELDS OF OATS FROM VARIOUS SOURCES OF NITROGEN USING 30 POUNDS OF NITROGEN PER ACRE

Treatment	Bushels per Acre 1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
Unfertilized	40.3	20.8	23.1	49.2	0.6	13.9	11.7	22.7	15.1	27.2	21.1	24.8	22.5
Sodium Nitrate	70.5	61.7	68.4	102.0	10.4	58.2	53.6	53.3	51.7	65.6	65.6	69.9	60.9
Ammonium Nitrate	74.8	59.2	60.8	83.2	8.3	51.9	46.2	56.1	54.7	65.6	70.3	72.8	58.7
Ammonium Sulphate	69.2	56.5	49.9	66.4	6.1	39.8	40.6	50.7	55.4	62.0	65.3	72.8	52.9
Cyanamid	62.7	52.0	48.9	58.6	11.3	40.0	39.9	45.1	45.8	55.0	47.0	55.6	46.8
Cotton Seed Meal	58.1	37.0	34.1	67.0	3.5	20.0	21.3	37.0	34.0	45.9	39.0	41.5	36.5
½ C.S.M. and ½ S Nitrate	59.5	52.9	39.5	87.7	7.2	34.4	38.4	46.2	44.3	52.1	47.1	55.9	47.1

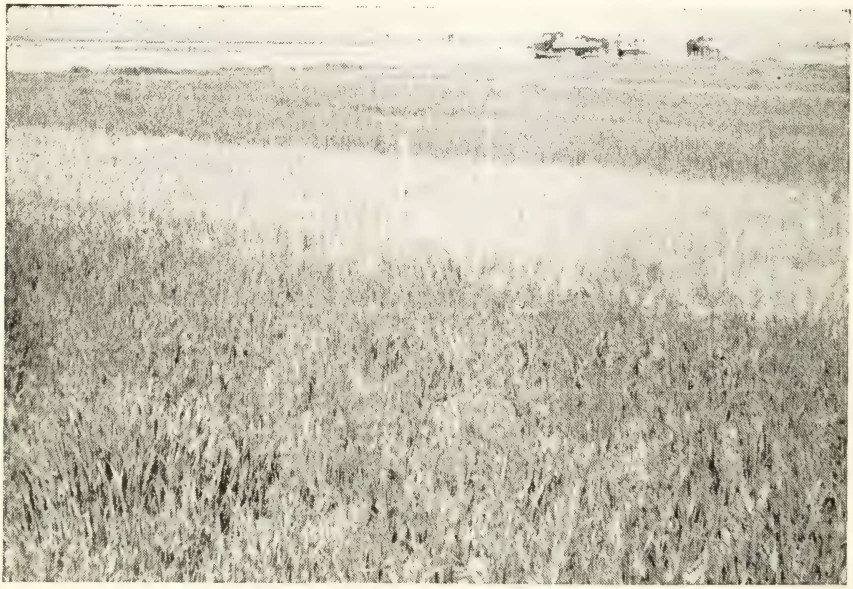

FIGURE 4—Oat fertilizer plats three weeks after the sources of nitrogen had been applied.

During the 12 year period in which old sources of nitrogen have been tested, all sources except cottonseed meal more than doubled the yield of the untreated or check plat. Thirty pounds per acre of nitrogen from sodium nitrate produced slightly higher yields than a like amount of nitrogen secured from other sources or materials, though the difference was slight when sodium nitrate was compared with ammonium nitrate. The increase in yields due to 30 pounds of nitrogen according to sources was as follows: nitrate of soda, 38.4 bushels; ammonium nitrate, 36.2 bushels; ammonium sulphate, 30.4 bushels; cyanamid, 24.3 bushels; cottonseed meal, 14.0 bushels; ½ cottonseed meal and ½ sodium nitrate, 24.6 bushels.

Thirty pounds of nitrogen is derived from the following amounts of indicated materials: sodium nitrate 188 pounds, calcium nitrate 200 pounds, calnitro 188 pounds, ammonium nitrate 167 pounds, ammonium sulphate 146 pounds, granular cyanamid 143 pounds, pulverized cyanamid 136 pounds, cottonseed meal 460 pounds.

New Sources of Nitrogen

In 1928 another experiment was begun in sources of nitrogen for oats in which some of the newer sources then on the market were compared with the older ones. This experiment was conducted on a diffrent field every year and on Sharkey loam soil, and treatments were replicated 5 to 8 times. The oats were seeded and fertilized as in the other sources of nitrogen experiment, and Norton oats were used throughout this test. The term, "new sources" is used to distinguish this experiment from the other. Results are shown in table 8.

TABLE VIII—YIELDS OF OATS FROM NEW SOURCES OF NITROGEN APPLIED AT 30 POUNDS OF NITROGEN PER ACRE ON DIFFERENT LAND EVERY YEAR

	Bushels per Acre					
						Av.
Treatment	1928	1929	1930	1931	1932	1928-32
Unfertilized	58.8	15.6	29.7	41.7	5.5	30.3
Sodium Nitrate	61.0	36.5	50.1	86.5	8.9	48.6
Calcium Nitrate	61.4	26.3	46.1	85.8	9.5	45.8
Ammonium Sulphate	71.2	30.9	37.5	85.1	7.5	46.4
Cyanamid	60.5	20.5	38.4	73.3	7.9	40.1
Leunasalpeter	65.7	32.6	44.8	99.0	6.7	49.8
Calurea	60.4	31.5	47.4	80.8	6.8	45.4

During the 5-year period, 1928-1932, the results indicate that Leunaspeter, sodium nitrate, and ammonium sulphate, produced higher yields in the order named than other sources included in the comparison. Nitrogen from these sources did not double the yields when compared with the unfertilized plats, as it did in the case of the older sources tests. This difference is due in part at least to different methods employed in conducting the test. The untreated check plats in the new sources test were on a new field each year, whereas the untreated check plats in the old sources test continued on the same unfertilized plat from year to year. Hence in the new sources test the unfertilized plats received the benefit of any residual effect that may have accumulated from fertilizer carried over from the previous year. The two experiments with sources of nitrogen coincide in showing that nitrogen, applied at the rate of 30 pounds per acre, serves approximately to double yields and is a most profitable practice in oat production.

Comparisons to Determine Results from Rates of Applying Nitrogen

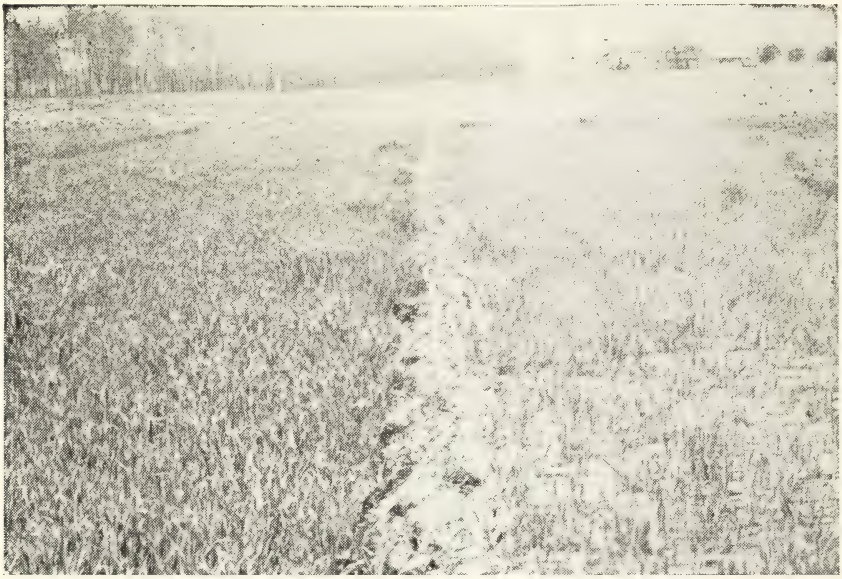

Figure 5—Left: Oats about three weeks after 188 pounds of Sodium Nitrate per acre had been applied. Right: Oats unfertilized.

Since nitrogen is the only major deficient fertilizing element in the west half of the delta, and is probably the most important factor for consideration in respect to increased crop yields, a test was inaugurated in 1928 to determine the most economical rate of applying nitrogen to oats. The rates were varied in 7½ pound increments up to 45 pounds of nitrogen per acre, and sodium nitrate was the source of nitrogen used. This experiment was in the same rotation as the sources of nitrogen experiment and was conducted under similar conditions. The fertilizer was applied in the spring. Ferguson 922 variety and its strains were used every year except 1932 and 1933, when Norton was planted. Yields secured from these rates of applying nitrogen are shown in table 9.

TABLE IX—YIELDS FROM RATES OF APPLYING NITROGEN IN 7½-POUND INCREMENTS UP TO 45 POUNDS PER ACRE, USING SODIUM NITRATE AS THE SOURCE

Nitrogen Rates	Bushels per Acre												
per Acre	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
No Nitrogen	33.5	25.3	22.6	37.2	1.0	16.3	9.2	26.2	14.9	24.6	22.3	26.1	21.6
7.5 pounds	42.4	32.1	25.6	44.8	4.1	27.1	18.5	37.8	26.1	45.2	39.0	39.3	31.8
15.0 pounds	52.5	43.5	37.6	57.1	5.6	41.9	31.3	53.1	39.9	60.0	51.7	50.0	43.7
22.5 pounds	65.1	45.7	46.6	77.2	9.3	44.6	34.2	44.1	48.9	63.2	60.3	60.4	50.0
30.0 pounds	69.4	50.4	56.2	79.2	7.6	57.9	51.0	54.3	63.0	71.5	61.7	69.8	57.7
37.5 pounds	78.5	58.4	62.8	77.3	5.0	61.6	57.0	57.4	64.0	74.3	64.8	73.5	61.2
45.0 pounds	73.4	63.5	66.8	73.6	9.6	70.3	72.2	59.5	68.8	63.3	71.9	75.0	64.0

Results of this work indicate that 30 pounds of nitrogen produced the most economical yields of oats, that the greatest response was obtained from less than 20 pounds of nitrogen per acre, and that very profitable increases were made from applications up to 40 pounds per acre. The application of 7½ pounds nitrogen increased the yield of the unfertilized plat by nearly 50 per cent, and applications of 15 pounds nitrogen more than doubled the yield of the unfertilized plat The use of 30 pounds of nitrogen increased the yield to 56.6 bushels per acre. The second increment, 15 pounds of nitrogen per acre, was the most profitable; and diminising returns began with the fifth increment when nitrogen application was at the rate of 37½ pounds nitrogen per acre. More than one bushel increase in oat yield was obtained for each pound of nitrogen used when the rate of application was 30 pounds per acre.

Time and method of fertilizer placement are important considerations wherever crops are fertilized. This is especially true in the instance of oats in the Yazoo-Mississippi delta, where the peak of work in cotton production coincides to some extent with the time at which oats are customarily fertilized. An experiment to determine the time at which oats may most profitably be fertilized was begun in 1928 and continued through 1936. The experiment was in the same rotation as the sources and rates of applying nitrogen tests, and was conducted under similar conditions and with the same variety of oats. Nitrogen was used at the rate of 30 pounds per acre and applied in separate plats at planting on three dates. Results of this work, measured in bushels of oats per acre, are shown in table 10.

TABLE X—YIELDS OF OATS FROM DATES OF APPLYING 30 POUNDS OF NITROGEN PER ACRE USING SODIUM NITRATE AS THE SOURCE

	Bushels per Acre								
Date of Application	1928	1929	1930	1931	1932	1933	1934	1936	Av.
No Nitrogen	30.5	25.3	29.3	45.7	0.7	20.3	9.5	14.3	22.0
November	46.2	60.7	60.0	100.3	3.8	59.5	41.8	53.3	53.2
March 15	57.2	59.7	62.7	101.8	8.2	44.6	51.7	59.2	55.6
April 1	64.6	65.8	62.2	70.4	4.5	40.5	50.7	48.9	51.0
April 15	60.2	64.1	63.8	94.3	2.0	28.2	21.1	47.6	47.7
½ November ½ April 1	53.7	62.6	62.8	90.4	5.6	40.3	48.3	56.8	52.6
½ November ½ April 15	66.8	61.9	59.1	89.3	3.7	29.7	35.6	49.3	49.4

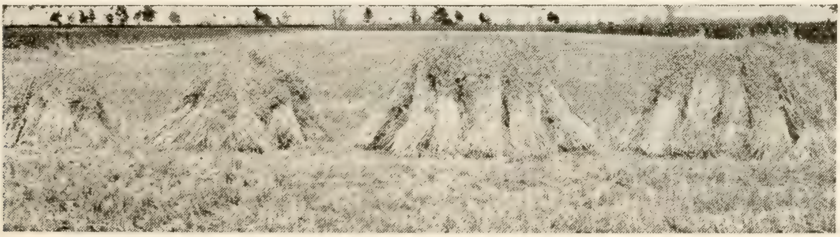

FIGURE 6—Oats in "Rates of Applying Nitrogen" experiment. Left to right: Unfertilized, 94, 188, and 282 pounds of Sodium Nitrate per acre, with 12 year average yields of 21.6, 43.7, 57.7, and 64.0 bushels per acre, respectively.

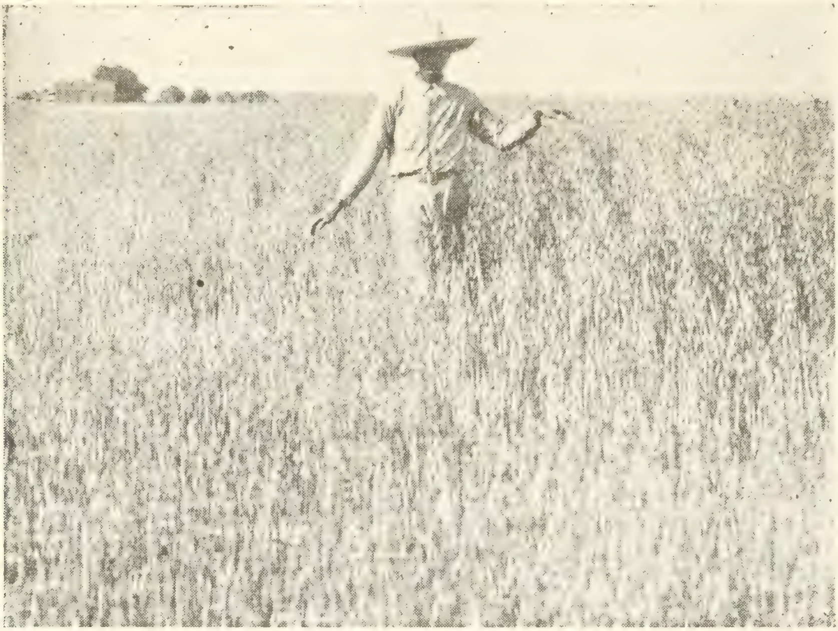

FIGURE 5—Left: Oats unfertilized. Right: Oats fertilized with 300 pounds of Sodium Nitrate per acre. Photographed just before harvested.

Eight years' work indicates March 15 as the best date to apply nitrogen to fall sown oats. It was regarded as significant, however, that during these 8 years the results of spring applications of nitrogen barely exceeded results of nitrogen applied at the time oats were planted.

In 1937 a new experiment was inaugurated for the purpose of comparing spring and fall applications of nitrogen to oats. Three sources of nitrogen were used—sodium nitrate, ammonium sulphate, and cyanamid—and treatments were uniformly at the rate of 30 pounds nitrogen per acre. Fall applications were made in late November, and spring applications were made in early March. Results are shown in table 11.

TABLE XI—YIELDS OF OATS FROM FALL AND SPRING APPLICATIONS OF SODIUM NITRATE, AMMONIUM SULPHATE AND CYANAMID, USING 30 POUNDS OF NITROGEN PER ACRE

	Bushels per Acre			
Source and When Applied	1937	1938	1939	Av.
Unfertilized	34.0	22.2	28.9	28.4
Sodium Nitrate—Fall	65.9	66.2	55.5	62.5
Ammonium Sulphate—Fall	64.5	61.4	54.2	60.0
Cyanamid—Fall	63.5	63.9	47.4	58.3
Sodium Nitrate—Spring	61.8	61.4	66.3	63.2
Ammonium Sulphate—Spring	62.9	57.2	65.2	61.8
Cyanamid—Spring	56.5	46.5	54.5	52.5

This experiment has been in progress only three years and the results are not yet conclusive. Results thus far are in accord with results of the 9-year experiment with dates of applying nitrogen, which indicated that sodium nitrate gave slightly better yields when applied March 15 over a period of 9 years. During the 3 years of this experiment. .7 bushels more oats were made when nitrate of soda was applied in the spring than when applied in the fall. 1.8 bushels more of oats were made when ammonium sulphate was applied in the spring than when applied in the fall, but 5.8 more bushels were made when cyanamid was applied in the fall than when applied in the spring. Higher yields in 1939, however, were obtained from the spring application of all three sources.

Oat Yields Compared with Corn Yields: Differences Scant When Fertilized

Corn is the principal grain crop produced in Mississippi, and this is true in the delta as in other areas of this state. Both crops produce satisfactory yields under proper methods of handling. Corn matures in the fall, while oats mature in the spring, and though there appears to be no conflict between these two crops, comparative yields may be of interest. Table 12 shows comparative yields of oats and corn.

TABLE XII—COMPARATIVE YIELDS OF FERTILIZED AND UNFERTILIZED OATS AND CORN

Treatment and Crop	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Av.
						Bushels of Grain per Acre						
Unfertilized Oats	40.3	20.8	23.1	49.2	0.6	13.9	11.7	22.7	15.1	27.2	21.1	22.3
Unfertilized Corn	32.6	16.8	10.0	45.3	17.4	16.0	11.5	15.3	9.7	11.2	18.7	18.6
Fertilized Oats	70.5	61.7	68.4	102.0	10.4	58.2	53.6	53.3	51.7	65.6	65.6	60.1
Fertilized Corn	69.2	32.4	24.0	62.1	35.7	26.7	28.8	30.7	13.4	40.7	33.5	36.1
						Pounds of Grain per Acre						
Unfertilized Oats	1290	666	739	1574	19	445	374	726	483	870	675	715
Unfertilized Corn	1826	941	560	2537	974	896	644	857	543	627	1047	1041
Fertilized Oats	2256	1974	2189	3264	333	1862	1715	1706	1654	2099	2099	1923
Fertilized Corn	3875	1814	1344	3478	1999	1495	1613	1719	750	2279	1876	2022

During the 12-year period, 1928-1939, direct comparisons were made of oat yields and corn yields. These tests indicate that unfertilized oats averaged 22.3 bushels per acre and unfertilized corn, 18.6 bushels per acre. Fertilized oats produced 60.1 bushels per acre, while fertilized corn produced 36.1 bushels per acre. Because of the difference in bushel weights of these two grains, a further comparison is in order. Unfertilized oats produced 715 pounds of grain per acre and unfertilized corn produced 1041 pounds grain per acre. Fertilized oats produced 1923 pounds per acre and fertilized corn produced 2022 pounds per acre. These results indicate that oats produce more bushels of grain per acre than corn but fewer pounds of grain per acre.. Oats respond more readily to the use of nitrogen than corn and when supplied with nitrogen fertilizer, almost as many pounds of oats were produced per acre as of corn. There appears to be little choice between these two grains, and little need to choose between them. Both have a definite place in delta agriculture.

Appendix: Soil Improvement, Oat Smut, Army Worm, Pure Seed

An oat crop removes a considerable amount of plant food from the soil as shown by yields from the unfertilized and fertilized check plats in the fertilizer experiments. Successful oat production is therefore dependent upon high yields, secured either by commercial fertilization or the use of legumes turned under.

It is a practice in several parts of the delta to sow oats on land on which soybeans have been combined for grain or sweet clover is sown with the oats; production or turned under after the seed have matured, thereby obtaining a volunteer crop of soybeans in the oats before they are combined the next spring. Under another practice, alsike thereafter the oats are combined in the spring, the clover cut for hay during the summer, and the stubble allowed to grow the following winter when it is turned under for soil improvement. There is also a possibility of maintaining soil fertility in the Yazoo-Mississippi delta by seeding bur clover with the oats and permitting the clover to mature seed for a succeeding winter crop to be turned under for soil improvement.

If there is sufficient moisture in the soil, a crop of soybeans, cowpeas, sagrain, sudan grass or corn may be produced following an oat crop. Experiments are under way at the Delta Branch Station to determine what crops may be produced most profitably after oats, and yields that may be expected of such crops under average seasonal conditions.

Oat Smut

Controlling oat smut is an important problem. A simple method is to sprinkle a mixture of one pint of formaldehyde and ten gallons of water to 40 to 80 bushels of grain, turning them thoroughly with a shovel as they are being sprinkled.

Army Worm

Probably the most important insect attacking small grains is the army worm, **Cirphis unipuncta** (Haworth). The winter is passed mainly in the partly grown larvae stage. These larvae shelter in the soil about clumps of grasses or small grains, or under litter on the ground. They begin feeding early in the spring and develop moths which deposit their eggs for the first generation around the latter part of April or the first of May.. Within a few days the eggs hatch, producing young worms green in color which have a looping habit of crawling until about half grown. They may often be found by the thousands in fields of grass or small grains, and because of their habit of feeding at night, their presence is generally not suspected until the crop is nearly destroyed.. When the feed supply becomes exhausted in the fields where they have developed, the caterpillars move out in hordes or armies and attack nearby fields. When these worms become full grown they are nearly two inches long, of a dark green color, with a narrow broken stripe down the coster of the back and three light stripes on the sides, the lower one being of a yellowish shade. In the delta this generation pupates about the middle of May and the moths emerge within about two weeks.

The approved method of controlling the army worm is to poison them by scattering broadcast a poison-bran mixture in the fields of oats where they are feeding, or across the line of march of worms when they are leaving the fields where food has become scarce. A very good bait for this purpose is as follows:

- 25 pounds of dry wheat bran
- 3 gallons of water
- 2 quarts of cheap molasses
- 1 pound of sodium arsenite, or Paris green, or white arsenic.

A satisfactory kill may be expected when the bait is used in oats at the rate of 12 pounds to the acre.

Pure Seed

Oat production has an important place in delta farming. A greatly increased acreage of oats might be profitably utilized as feed for work stock on the farm where grown, for marketing as feed oats, and for sale as seed oats. Possibly the greatest hindrance to profitable oat production at present is the prevalence of infestations of cheat, chess, and other weeds which result in poor quality and low yield. During the harvesting period of 1939, inspections were made of numerous plantings of oats in the delta for the purpose of seed certification. In numerous instances, certification was necessarily withheld because of the considerable contamination with weeds. Fully to utilize the opportunity for profitable oat production in the Mississippi delta requires adoption of proven practices with respect to varieties, fertilization, and handling. The full utilization of this opportunity also involves the necessity, first, of securing weed-free seed oats of the desired variety, and second, of maintaining freedom from weed seeds by constant vigilance, especially at the time of harvesting.

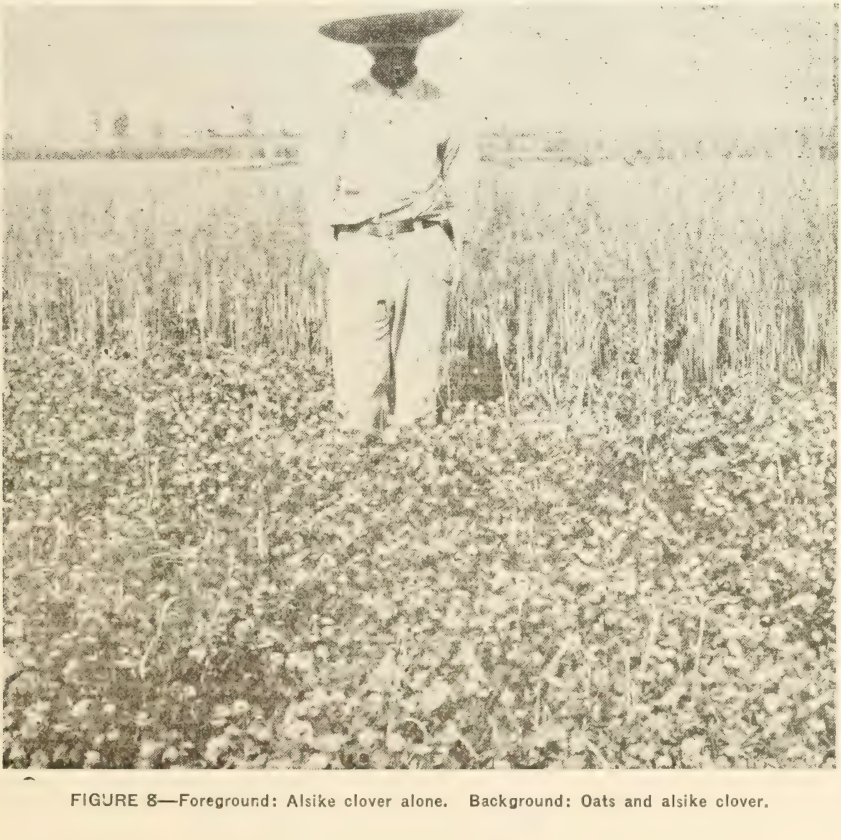

FIGURE 8—Foreground: Alsike clover alone. Background: Oats and alsike clover.

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BROILER PRODUCTION

Compiled by
H. O. WEST

Coordinator Research Information
Jointly Representing
Mississippi Agricultural Experiment Station
and
Mississippi State Vocational Board

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INTRODUCTION

In this compilation on "Broiler Production", an attempt has been made to present information on most phases of the broiler business. The information is divided into sections as follows:

First Section. The results of a study made in the Jackson broiler producing area, experiment station study, and the results of a study made in Western Indiana are presented to answer the question, "Is Broiler Production Profitable"?

Second Section. In this section the question of securing baby chicks is discussed to emphasize the importance of securing good chicks.

Third Section. Housing and brooding is very important in producing broilers. Information is presented on recommended houses, houses used in the broiler producing area, and comparison of different type brooders.

Fourth Section. Feeding is a problem confronting every broiler producer. Information is presented here on feeding protein, vitamins, minerals, and simple and complex rations.

Fifth Section. Marketing is one of the most vital factors in a broiler business. In this section, broiler prices on the New Orleans, New York, and Chicago markets are given for a ten year period, also suggested ways of marketing broilers.

Sixth Section. Diseases and parasites very often cause the broiler producer severe losses. The most common diseases and parasites are discussed in this section.

The very helpful and constructive suggestions and criticism offered by Mr. G. R. Sipe of the Poultry Department, Mr. V. G. Martin and staff of the Agricultural Education Department were very helpful in preparing this bulletin. This cooperation is appreciated.

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IS BROILER PRODUCTION PROFITABLE?

In studying ~~information on~~ broiler production it was found that there was a very limited amount of information showing the cost of production of broilers in Mississippi. Due to this fact a study of broiler production in Smith, Rankin and Scott county areas was made in an effort to secure this type of information. Broiler and fryer production in Mississippi seems to be on a very definite increase, especially in the above mentioned area. It has been estimated that possibly one-half million broilers and fryers have been marketed from this area in 1939. A survey was made on 25 farms in this area involving approximately 30,000 broilers. The farms were visited to get actual conditions under which the chicks were produced. The broiler business in this section is promoted mainly by feed dealers. The feed dealers supply the farmers with the baby chicks and feed necessary to produce the broilers. In most cases this is a credit business. When the chicks are ready to market the feed dealer buys the chicks from the farmer, the chick cost and feed cost being deducted at the time of the sale. The feed dealer in turn markets the chicks in Jackson and New Orleans. Breeds used in this area are mostly Barred Rocks and White Rocks. Practically all the White Rocks are marketed in Jackson and a high percentage of the Barred Rocks are marketed in New Orleans. The number of chickens per farm ranged from 250 to 9,000. This variation in the number of chicks per farm was gotten in order that a comparison of the profit per pound with different number of chicks per farm might be made.

The housing conditions found in this area were ordinary. Most of the houses were boxed type, frame buildings with a large percentage having dirt floors. The approximate size was 16 feet x 16 feet per 500 chicks. On the farms using litter, peat moss was the source. The peat moss was put in the houses when the baby chicks were secured and the litter was not changed until the chicks were marketed. There were two types of brooders found in the study. Fifteen used thermostat control brooders and 10 used brick brooders. All used wood as the source of fuel. The farmers using the thermostat control wood brooders estimated about one-half as much wood was used in brooding as the ones using the brick brooders.

All farms in this study used commercial feed which consisted of battery mash and grain. The amount of feed used on each farm was ascertained from the feed store books.

The battery mash contained the following ingredients: Dried buttermilk, dried whey, meat scraps, selected fish meal, yellow corn meal, soybean oil meal, corn gluten meal, ground oat groats, pulverized heavy oats, wheat bran, wheat gray shorts, ground wheat, alfalfa leaf meal, fortified cod liver oil, 2% calcium carbonate (from limestone), 1.80 of 1% maganese sulphate, and 1% salt.

The grain was chick grain and corn chops. On practically all farms the first feed given the chicks was chick grain. This feed was fed for three or four days. After this the chicks were fed all battery mash for four to six weeks. At this time the battery mash was supplemented with corn chops.

Table 1 shows a compilation of the surveys from this area. You will note from this tabulation that the cost per pound includes only the cost of feed and the cost of chicks. The figures in this tabulation are prepared using present prices of feed, chicks and prices paid for broilers. In using this information it will be necessary from time to time to adjust cost of feed, cost of chicks and value of chicks to the present market conditions in order to get an accurate picture.

Table 2 is a study or grouping of the above mentioned survey. The grouping was made on the basis of high, medium and low profit groups to show some of the facts that may influence the profit secured in producing broilers. It was thought wise to make a similar tabulation using experimental tests in order that a comparison of results under actual farm conditions to results from experimental tests might be made.

Table 3 represents a compilation of experimental tests. These tests were conducted in Alabama, Missouri, Mississippi, Indiana, and Delaware. In making this compilation the present price of feed was used. In getting the cost of chicks the average paid by the Mississippi groups was used, also the average price per pound received by the Mississippi group was used in figuring the value of chicks. In reviewing the above tabulations a clear comparison can be made of the experimental tests to actual farm conditions.

In getting information on broiler production cost a report on a study of approximately 200,000 chickens by Purdue University was secured. It was thought advisable to include the results in terms of averages, of this study. Table 4 gives the results of this study made in Western Indiana, also the average of the Mississippi area and Experiment Station study. The Indiana study was made in 1935-1936, 1936-1937. The actual cost of feed and chicks during this period was used which might vary from prices of feed and chicks at any given time. These facts should be taken into consideration in making comparisons from this study. It will also be noted that in the profit per pound per chick was higher compared to the Mississippi study. This average may be explained by the following fact. In the Mississippi area the price received averaged approximately 19c per pound and in Indiana in 1936 the average price was approximately 23c and, for 1937, the average price was 22.5c per pound. As stated above these facts should be taken into consideration in making a comparison. In this study approximately 225,000 broilers are involved which should give a fairly accurate picture of what to expect in the production of broilers under farm conditions.

Table 1

Summary of Broiler Production Studies in Jackson, Mississippi Area

Number Chicks Started	Mortality		No. Chicks Sold	Time Fed	Av. Wt.	Amt. Feed Used		Total Feed	Cost of Mash	Cost of Grain	Cost of Chicks	Total Cost	Lbs. of Chicks Sold	Cost Per Lb.	Lbs. feed Per Lb. Gain	Value of Chicks*	Returns Above Cost	Profit Per Lb.
	No.	%		Weeks	Lbs.	Mash	Grain											
800	120	15.0	680	11	2.45	3,400	1,700	5,100	$ 102.00	$ 42.50	$ 60.00	$ 204.50	1,615	12.6	3.15	$ 323.00	$ 118.50	7.3
1,800	155	8.6	1,645	13	2.54	11,800	3,100	14,900	395.30	67.70	144.00	607.00	4,194	14.4	3.55	838.95	231.95	5.5
1,030	32	2.4	998	11	2.00	5,800	1,500	7,300	188.50	30.75	80.00	299.25	1,996	14.99	3.66	399.20	99.95	5.0
4,000	625	15.6	3,375	11	2.25	20,800	5,600	26,400	624.00	100.80	280.00	1,004.80	7,594	13.23	3.47	1,452.86	448.06	5.9
2,100	332	15.8	1,768	11	2.22	13,400	300	13,700	398.30	25.50	147.00	570.80	3,942	14.47	3.47	768.69	197.89	5.0
450	139	30.8	311	13	3.21	2,600	900	3,500	78.00	17.25	33.75	129.00	1,000	12.9	3.5	200.00	71.00	7.1
500	136	27.2	364	12	2.67	2,600	1,100	3,700	78.00	21.50	27.50	137.00	975	14.05	3.79	195.00	58.00	5.94
350	49	14.0	301	11	2.50	2,000	700	2,700	60.00	13.80	24.50	98.30	757	12.98	3.56	151.40	53.10	7.01
500	59	11.8	441	11	2.48	2,400	1,000	3,400	72.00	19.80	35.00	126.80	1,095	11.57	3.10	219.10	92.30	8.42
250	45	18.0	205	12	2.60	1,500	700	2,200	45.00	13.80	17.50	76.30	533	14.31	4.12	106.70	30.40	5.70
500	33	6.6	467	13	2.97	3,000	800	3,800	90.00	14.40	40.00	144.40	1,389	10.39	2.73	250.02	105.62	7.60
500	120	24.0	380	12	2.77	2,800	900	3,700	84.00	16.20	40.00	140.20	1,054	13.30	3.51	210.80	70.60	6.69
500	16	3.2	484	12	2.92	4,100	1,300	5,400	123.00	23.40	37.50	183.90	1,415	12.99	3.81	254.70	70.80	5.00
1,000	182	18.2	818	11	2.44	4,400	2,100	6,500	132.00	42.00	70.00	244.00	2,004	12.17	3.24	400.80	156.80	7.78
950	74	7.7	876	11	2.02	4,300	1,500	5,800	129.00	30.00	66.50	225.50	1,778	12.65	3.26	346.75	121.25	7.26
650	90	13.8	560	12	2.62	3,500	1,200	4,700	105.00	21.60	52.00	178.60	1,470	12.14	3.19	255.06	76.46	5.20
200	22	11.0	178	13	2.88	1,100	500	1,600	33.00	9.60	16.00	58.60	514	11.40	3.11	92.52	33.92	6.59
500	38	7.6	462	11	2.16	2,600	700	3,300	78.00	12.60	40.00	130.60	997	13.09	3.30	209.37	78.77	7.90
500	45	9.0	455	13	2.55	2,500	1,000	3,500	75.00	18.00	40.00	133.00	1,161	11.45	3.29	208.98	75.98	6.54
500	57	11.4	443	13	2.62	3,200	900	4,100	96.00	16.20	40.00	152.20	1,164	13.07	3.52	209.52	57.32	4.92
1,000	152	15.2	848	11	2.38	4,600	1,500	5,100	138.00	28.00	80.00	246.80	2,024	12.19	2.51	394.68	147.88	7.30
1,000	124	12.4	876	11	2.39	4,900	1,400	6,300	147.00	25.20	80.00	252.20	2,096	12.50	3.00	398.24	146.04	6.49
500	52	10.4	448	11	2.16	2,600	700	3,300	78.00	12.60	40.00	130.60	997	13.09	3.30	209.37	78.77	7.90
250	55	22.0	195	11	2.02	1,400	400	1,800	42.00	8.40	20.00	70.40	394	17.86	4.56	78.80	8.40	2.13
9,000	1,275	14.1	7,725	12	2.64	54,000	10,800	64,800	1,620.00	274.00	720.00	2,614.00	20,471	12.76	3.16	3,684.78	1,070.78	5.23
29,600	4,052	13.68	25,548	11.72	2.45	165,000	42,300	207,600	5,011.10	906.40	2,241.25	8,158.75	62,629	13.02	3.31	11,859.29	3,700.54	5.90

*Price received per lb. 18 to 21c—an average of 19c per lb.

Table 2

High, Medium, and Low Profit Groups in the Jackson Area

No. Chicks Started	Mortality		No. Chicks Sold	Time Fed	Average Wt.	Amt. Feed Used		Total Feed	Cost of Mash	Cost of Grain	Cost of Chicks	Total Cost	Lbs. of Chicks Sold	Cost Per Lb.	Lbs. feed Per Lb. Gain	Value of Chicks	Returns Above Cost	Profit Per Lb.	
	No.	%		Weeks		Mash	Grain												
800	120	15.0	680	11	2.37	3,400	1,700	5,100	$ 102.00	$ 42.50	$ 60.00	$ 204.50	1,615	12.6	3.15	$ 323.00	$ 118.50	7.3	
450	139	30.8	311	13	3.21	2,600	900	3,500	78.00	17.25	33.75	129.00	1,000	12.9	3.5	200.00	71.00	7.1	
350	49	14.0	301	11	2.51	2,000	700	2,700	60.00	13.80	24.50	98.30	757	12.98	3.56	151.40	53.10	7.01	
500	59	11.8	441	11	2.48	2,400	1,000	3,400	72.00	19.80	35.00	126.80	1,095	11.57	3.10	219.10	92.30	8.42	
500	33	6.6	467	13	2.97	3,000	800	3,800	90.00	14.40	40.00	144.40	1,389	10.39	2.73	250.02	105.62	7.60	
1,000	182	18.2	818	11	2.44	4,400	2,100	6,500	132.00	42.00	70.00	244.00	2,004	12.17	3.24	400.80	156.00	7.78	
950	74	7.7	876	11	2.02	4,300	1,500	5,800	129.00	30.00	66.50	225.50	1,778	12.65	3.26	346.75	121.25	7.26	
500	38	7.6	462	11	2.16	2,600	700	3,300	78.00	12.60	40.00	130.00	997	13.09	3.30	209.37	78.77	7.90	
1,000	152	15.2	848	11	2.38	4,600	1,500	5,100	138.00	28.80	80.00	246.80	2,024	12.19	2.51	394.68	147.88	7.30	
500	52	10.4	448	11	2.16	2,600	700	3,300	78.00	12.60	40.00	130.60	997	13.09	3.30	209.37	78.77	7.90	
6,550	898	137.3	5,652	114	24.76	31,900	11,600	42,500	957.00	233.75	489.75	1,679.20	13,656	123.63	31.65	2,704.49	1,025.29	75.57	Total
655	90	13.7	565	11	2.47	3,190	1,160	4,250	95.70	23.37	48.97	167.20	1,365	12.36	3.16	207.44	102.52	7.5	Av.
1,800	155	8.6	1,645	13	2.54	11,800	3,100	14,900	395.30	67.70	144.00	607.00	4,194	14.4	3.55	838.95	231.95	5.5	
4,000	625	15.6	3,375	11	2.25	20,800	5,600	26,400	624.00	100.80	280.00	1,004.80	7,594	12.23	3.47	1,452.86	448.06	5.9	
500	136	27.2	364	12	2.67	2,600	1,100	3,700	78.00	21.50	37.50	137.00	975	14.05	3.79	195.00	58.00	5.94	
250	45	18.0	205	12	2.60	1,500	700	2,200	45.00	13.80	17.50	76.30	533	14.31	4.12	106.70	30.40	5.70	
500	120	24.0	380	12	2.77	2,800	900	3,700	84.00	16.20	40.00	140.20	1,054	13.30	3.51	210.80	70.60	6.69	
200	22	11.0	178	13	2.88	1,100	500	1,600	33.00	9.60	16.00	58.60	514	11.40	3.11	92.52	33.92	6.59	
500	45	9.0	455	13	2.55	2,500	1,000	3,500	75.00	18.00	40.00	133.00	1,161	11.45	3.29	208.98	75.98	6.54	
1,000	124	12.4	876	11	2.39	4,900	1,400	6,300	147.00	25.20	80.00	252.20	2,096	12.50	3.00	398.24	146.04	6.49	
8,750	1,272	118.0	7,478	97	20.65	48,000	14,300	62,300	1,481.30	272.80	655.00	2,419.10	18,121	104.64	27.84	3,504.05	1,084.95	49.35	Total
1,093	159	14.7	934	12	2.58	6,000	1,787	7,787	185.16	34.12	81.87	302.38	2,265	13.08	3.48	438.00	135.61	6.16	Av.
1,030	32	2.4	998	11	2.00	5,800	1,500	7,300	188.50	30.75	80.00	299.25	1,996	14.99	3.66	399.20	99.95	5.0	
2,100	332	15.8	1,768	11	2.22	13,400	300	13,700	398.30	25.50	147.00	570.80	3,942	14.47	3.47	768.69	197.89	5.0	
500	16	3.2	484	12	2.92	4,100	1,300	5,400	123.40	23.40	37.50	183.90	1,415	12.99	3.81	254.70	70.80	5.0	
650	90	13.8	560	12	2.62	3,500	1,200	4,700	105.00	21.60	52.00	178.60	1,470	12.14	3.19	255.06	76.46	5.2	
500	57	11.4	443	13	2.62	3,200	900	4,100	96.00	16.20	40.00	152.20	1,164	13.07	3.52	209.52	57.32	4.9	
250	55	22.0	195	11	2.02	1,400	400	1,800	42.00	8.40	20.00	70.40	394	17.86	4.56	78.80	8.40	2.13	
9,000	1,275	14.1	7,725	12	2.64	54,000	18,000	64,800	1,620.00	240.00	720.00	2,614.00	20,471	12.76	3.16	3,684.78	1,070.78	5.23	
14,030	1,857	82.7	12,173	82	17.04	85,400	23,600	101,800	2,572.80	399.85	1,096.50	4,069.15	29,382	98.28	25.37	5,650.75	1,581.60	32.48	Total
2,004	267	11.8	1,739	11.7	2.43	12,200	3,371	14,542	367.54	57.12	156.64	581.30	4,197	14.04	3.62	807.25	225.94	4.64	Av.

Table 3

Tabulation of Experimental Tests

No. Chicks Started	Mortality		No. Chicks Sold	Time Fed	Av. Wt.	Amt. Feed Used		Total Feed	Cost of Mash	Cost of Grain	Cost of Chicks	Total Cost	Lbs. of Chicks Sold	Cost Per Lb.	Lbs. Feed Per Lb. Gain***	Value of Chicks**	Returns Above Cost	Profit Per Lb.	
	No.	%		Weeks	Lbs.	Mash	Grain												
275	28	10.0	247	8	.825	570		570	$ 9.85		$ 20.62	$ 30.47	201.8	15c	2.82	$ 38.34	$ 7.87	3.9c	
275	33	12.1	242	8	.655	479	535*	1,014	5.50	$ 2.67*	20.62	28.79	159.0	18	6.4	30.21	1.42	.88	
275	29	10.4	246	8	.770	539	548*	1,087	7.25	2.74*	20.62	30.61	189.0	16.2	5.7	33.06	2.45	1.3	
275	50	18.5	225	8	.715	517	531*	1,048	6.97	2.65*	20.62	30.24	161.0	18.7	6.5	30.59	.35	.22	
275	35	12.8	240	8	.705	499	504*	1,003	6.05	2.52*	20.62	29.19	169.0	17.2	6.0	32.11	2.92	1.7	
1,669	155	9.6	1,469	12	1.93	10,364	1,953	12,317	240.36	28.31	125.17	398.84	2,922	13.4	4.2	555.18	161.34	5.5	
28	3	10.7	25	8	1.30	122.92		122.92	2.47		2.10	4.57	32.5	14.0	3.44	6.17	181.60	5.0	
28	1	3.5	27	8	1.75	147.23		147.23	3.20		2.10	5.30	47.25	11.2	3.10	8.97	3.67	7.8	
28	2	7.0	26	8	1.67	127.44		127.44	2.72		2.10	4.82	43.42	11.1	2.9	8.25	3.42	7.9	
30	2	6.6	28	8	1.62	126.33		126.33	3.18		2.25	5.43	45.36	11.9	2.6	8.62	3.19	7.1	
30	0	0.0	30	8	1.66	130.17		130.17	2.91		2.25	5.16	49.80	10.3	2.61	9.46	4.30	8.7	
30	0	0.0	30	8	1.32	113.65		113.65	2.85		2.25	5.10	39.60	12.8	2.86	7.52	2.42	6.2	
100	2	2	98	8	1.32	388		388	7.43		7.50	14.93	129.36	11.5	3.00	24.58	9.65	7.4	
100	2	2	98	8	1.54	435		435	8.87		7.50	16.37	150.90	10.8	2.88	28.67	12.30	8.1	
213	11	5.1	202	8	1.05	774		774	14.87		15.97	30.84	212.0	14.5	3.65	40.28	9.44	4.4	
213	19	8.9	194	8	1.31	836		836	16.23		15.97	32.20	254.0	12.6	3.29	48.26	16.06	6.3	
97	7	6.3	90	8	1.25	327		327	6.36		7.27	13.63	112.5	12.1	2.91	21.37	7.74	6.8	
97	7	6.3	90	8	1.34	332		322	6.75		7.27	14.02	120.6	11.6	2.75	22.91	8.89	7.3	
158	13	8.2	145	8	1.15	525		525	9.54		11.85	21.39	166.7	12.8	3.15	31.67	10.28	6.1	
265	40	15.1	225	8	1.26	831		831	15.82		19.87	35.69	283.5	12.5	2.93	53.87	18.18	6.4	
207	5	2.4	202	11	2.20	1,649		1,649	26.49		15.52	46.27	444.4	10.4	3.78	84.43	38.16	8.6	
207	8	3.9	199	11	2.39	1,682		1,682	29.72		15.52	49.28	475.6	10.3	3.63	90.36	41.08	8.7	
207	8	3.9	199	11	2.43	1,715		1,715	33.02		15.52	52.38	483.6	10.8	3.60	91.88	39.50	8.2	
207	17	8.2	190	11	2.46	1,675		1,675	34.73		15.52	53.70	467.4	11.5	3.69	88.80	35.10	6.5	
5,289	477	173.5	4,767	208	34.62	24,904.74		28,965.74	504.14		396.60	954.22	7,360.29	311.20	88.39	1,395.56	441.34	141.0	Total
202	18	7.2	198	8.6	1.44	1,037.69		1,206.90	20.96		16.52	39.34	306.67	12.96	3.69	57.72	31.88	5.99	Av.

*Skimmilk

**Used the average price of 19c per lb. received by Jackson Area in computing value of chicks.

***In comparing the amount of feed per lb. gain in this tabulation, you will notice in the first test that skimmilk was used, and that the skimmilk was figured in the average lbs. of feed per lb. of gain which might have a bearing on the amount of feed required to produce a lb. of chick in this tabulation.

Table 4 Combined Tabulation of Western Indiana Area, Jackson Area, and Experiment Station Tests

	No. Chicks Started	Mortality		No. Chicks Sold	Time Fed	Av. Wt.	Amt. Feed Used		Total Feed	Cost of Mash	Cost of Grain	Cost of Chicks	Total Cost	Lbs. of Chicks Sold	Cost Per Lb.	Lbs. Feed Per Lb. Gain	Value of Chicks	Returns Above Cost	Profit Per Lb.
		No.	%		Weeks	Lbs.	Mash	Grain											
Indiana																			
1935-36	101,186	15,856	15.7	85,330		2.67			1,159,330	$20,625.50		$ 9,568.60	$30,194.10	227,989	13.24	5,085	$ 52,832.56	$22,638.46	9.93
1936-37	90,494	10,446	11.5	80,044		2.88			1,006,176	27,256.87		7,884.40	35,141.27	230,487	15.25	4,365	52,409.91	17,268.64	7.49
TOTAL	191,680	26,302	13.6	165,374		2.77			2,165,506	47,882.37		17,453.00	65,335.37	458,476	14.24	4,725	105,242.47	39,907.10	8.71*
Jackson, Mississippi Area																			
	29,600	4,052	13.0	25,548	11.72	2.45	165,300	42,300	207,600	$5011.10	$906.46	2,241.25	8,158.75	62,629	13.02	3.31	11,859.29	3,700.54	5.90
Experiment Stations																			
	5,289	477	7.2	4,767	8.6	1.44	24,904.74		28,965.74	504.14		296.60	954.22	7,360	12.96	3.69	1,395.51	441.34	5.99

*The profit per lb. in the Indiana tabulation is high as compared to Jackson Area. This is due to prices received for broilers. In 1936 the price was 23c per lb. and in 1937, 22.5c per lb. The Jackson area averaged 19c per lb.

SECURING BABY CHICKS

The factor of securing chicks is very important to the broiler producer. A great deal of care should be exercised to see that good healthy chicks are secured. They should be from blood tested flocks. In many instances chicks are bought that are infected with white diarrhea causing heavy losses to the producer.

There are several methods of securing chicks.

1. Hatching own eggs in incubator.
2. Having eggs hatched at hatchery.
3. Buying day old chicks.

Example of Cost of Chicks by Different Methods

	Hatching at Home in Incubator*		Having Eggs Hatched at Hatchery*	Buying Day Old Chicks**
Kerosene	21 gals.	$2.52		
Eggs	450 at 25c per dozen	9.38	100 at 25c per dozen $2.08	
Labor	21 hours at 10c	2.10		
Rent on incubator		2.50		
Having eggs hatched			2.50	
Total cost		16.50	4.58	
% hatchability	56%		56%	
No. chicks hatched	252		56	
Cost per chick	6.5c		8.1c	7.57c

*The prices used in this calculation should be secured for each locality and this calculation made. Taking an average of several tests the hatchability averaged 56%. This figure was used in this calculation.

**The average cost of chicks in Jackson Area.

Comparison of Cost of Purchased Chicks with Farm Hatched

Year	Purchased Chicks Cost per 100	Farm Hatched Chicks Cost per 100
1933-34	$7.73	$6.35
1934-35	8.75	8.10
1935-36	9.48	6.57
3 year average	$8.65	$7.00

These are the results of a study made in Indiana in comparing purchased chicks with farm hatched chicks.

Suggestive Questions

1. What is the best way of securing chicks?
2. What risks are involved in hatching own chicks?
3. How does hatching own chicks compare with buying day old chicks?
4. What risks are involved in having eggs hatched at hatchery?
5. Will enough money be saved in hatching own chicks to overcome the risk involved?
6. By what method may best quality chicks be secured?

HOUSING

Housing is very important in the production of broilers especially during the winter months. A great many times entire flocks of chicks are lost due to housing conditions.

The following points should be considered in constructing a brooder house.

1. Location: Careful consideration of the place to locate a brooder house is essential to successful brooding. It should not be located close to hog pens or other livestock buildings.

The soils should be well drained. A brooder house on poorly drained soil causes a damp house which is very bad on chicks. The house should be placed where shade is available, without cutting out direct sunshine. Sunshine is very necessary in growing young chicks, vitamins are supplied and helps disinfect the house. The house should face the south if possible allowing a maximum of sunlight to enter.

2. Size: Number of chicks to be brooded should be considered in figuring size of the house. Crowding chicks causes many brooding failures.

3. Ventilation: A poorly ventilated house is damp, close and unhealthful for chicks. Ample ventilation is necessary to remove the moisture which the fowls have exhaled, and also odors and gases. Ample ventilation should be gotten without having drafts. Drafts on young chicks often causes roup or colds, and is very serious at times.

4. Sunlight and dryness: Good ventilation, drainage, and plenty of sunlight are essential in keeping the house dry. A dry house is very important, because the chicks give off body moisture in the breath, this moisture should pass out.

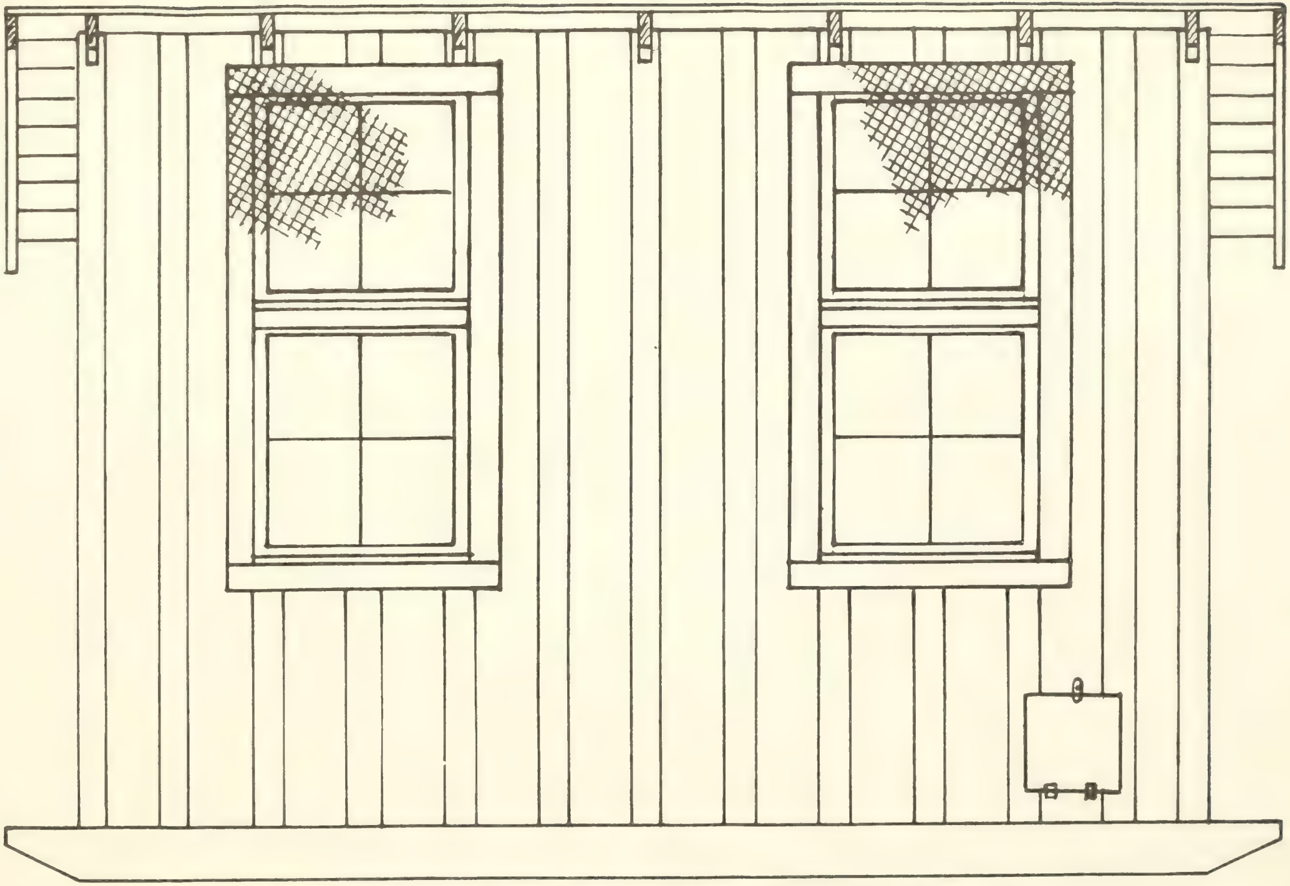
Sunlight is far better than any disinfectant in destroying disease germs.

To construct a brooder house a plan or blue print will be needed. The plan of a brooder house has been wroked out by the Poultry Department of the Mississippi Extension Service. This plan is presented here as a suggested brooder house plan, also giving the material necessary to construct this house.

Suggestive Questions

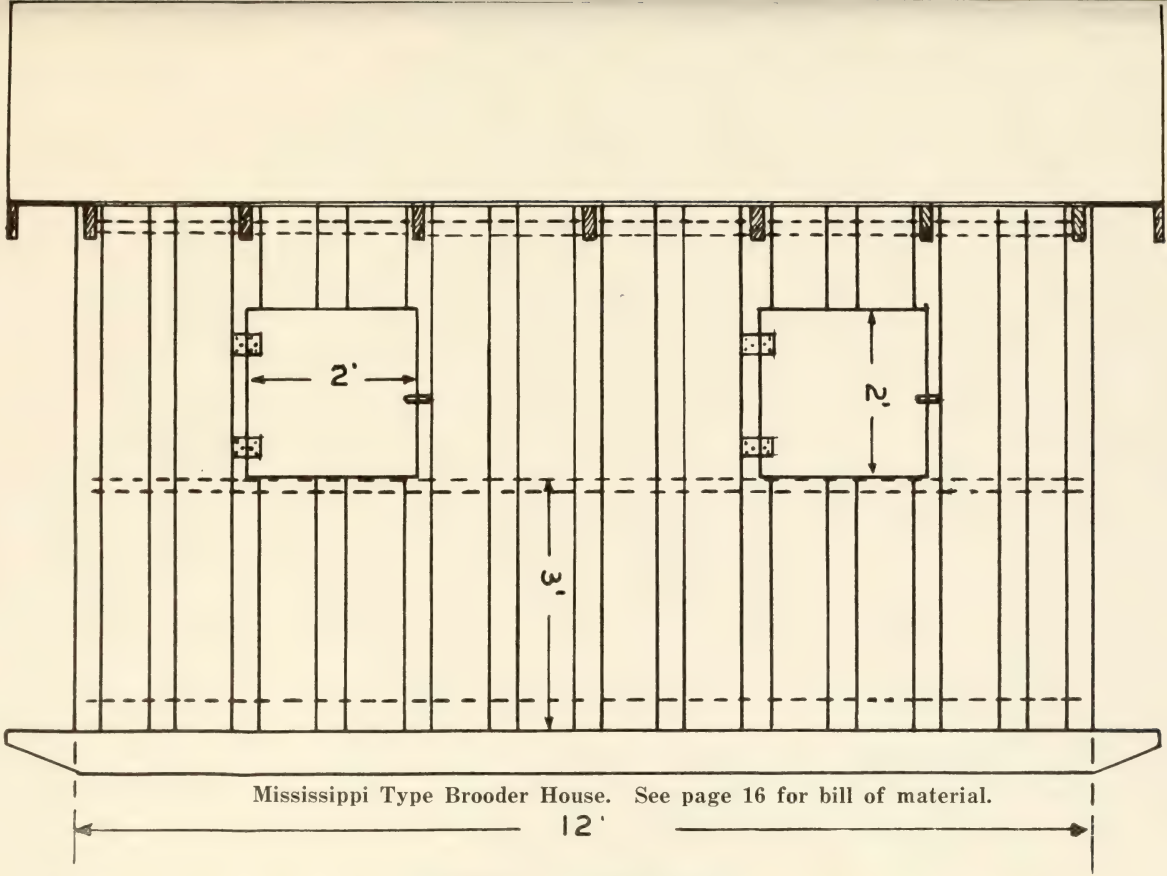
1. Where should the brooder house be located?
2. What should determine the size brooder house to build?
3. What points should be considered in building a brooder house?

The following illustrations are for a 10'x12' portable brooder house.



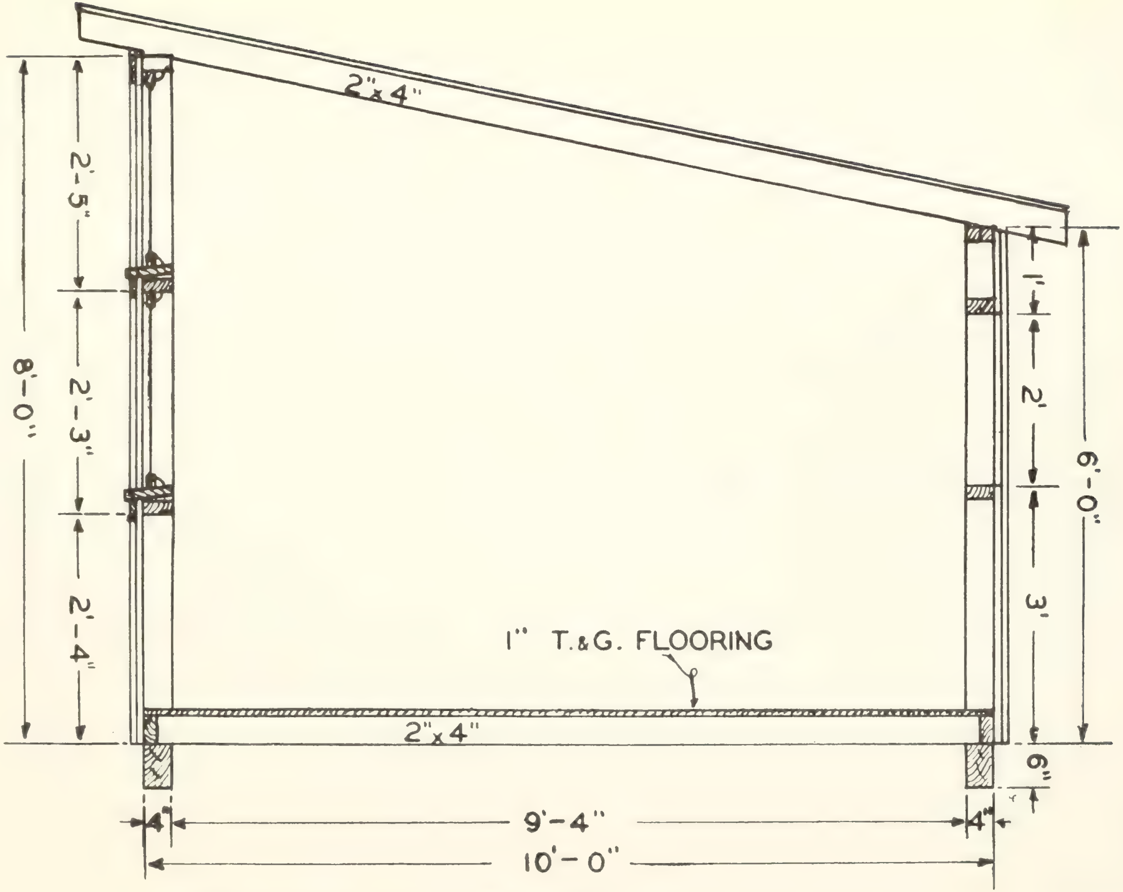
Mississippi Type Brooder House. See page 16 for bill of material.

FRONT ELEVATION



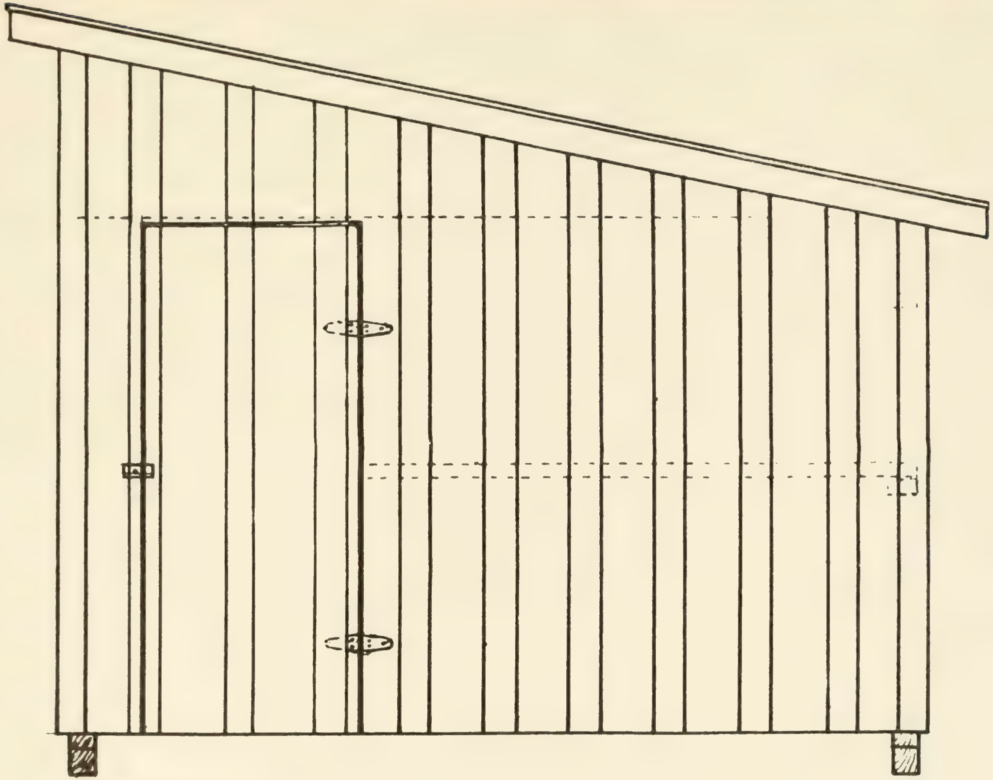
Mississippi Type Brooder House. See page 16 for bill of material.

BACK ELEVATION


2"x4"
2'-5"
2'-3"
2'-4"
8'-0"
1'
2'
3'
6'-0"
6"
1" T.&G. FLOORING
2"x4"
4"
9'-4"
4"
10'-0"

Mississippi Type Brooder House. See page 16 for bill of material.

CROSS SECTION



Mississippi Type Brooder House. See page 16 for bill of material.

EAST ELEVATION

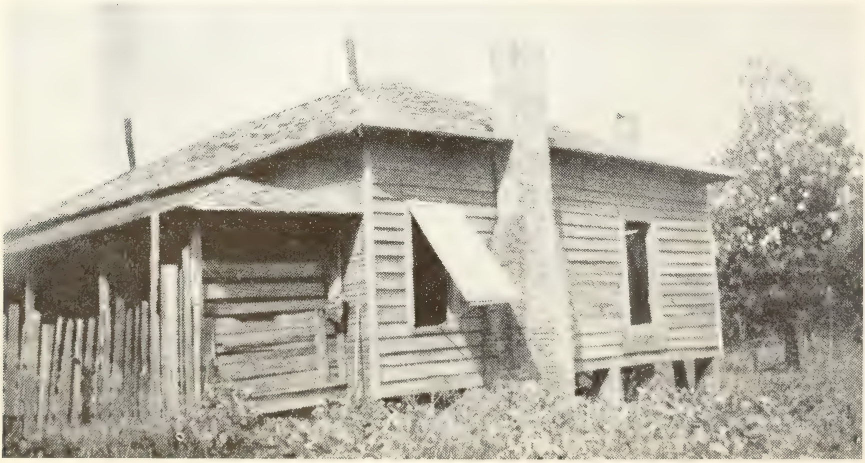
The following bill of material is suitable for the 10x12 foot house as shown on pages 12, 13, 14 and 15. Blue prints giving detailed information on house construction may be obtained by writing the State Extension Service, State College, Mississippi.

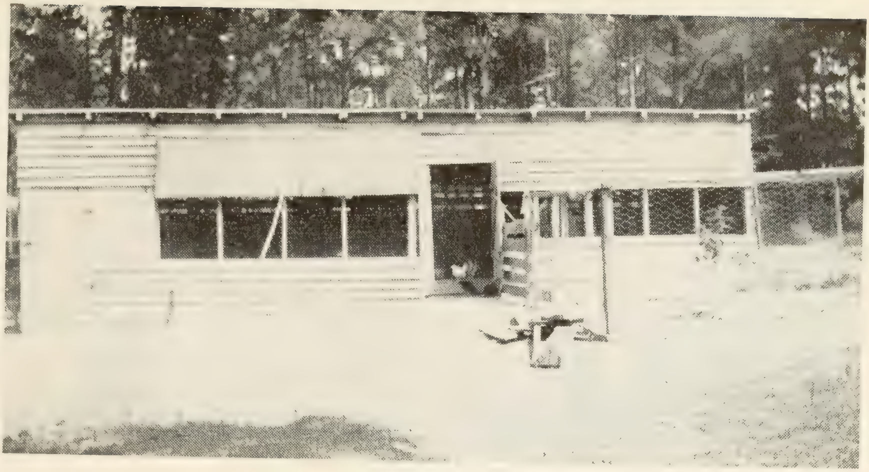
	Runners
2	4"x6"—14'
	Floor Joints
7	2"x4"—10'
	Roof
7	2"x4"—12'
21	1"x8"—14' shiplap
13	pieces 6 foot V crimped galvanized iron roofing no less than 29 gauge or 1½ squares composition roofing.
	Floor
40	1"x4"—12' flooring
	Ends
4	2"x4"—10'
10	1"x12"—16'
10	1"x4"—16'
	Back
4	2"x4"—12'
6	1"x12"—12'
6	1"x4"—12'

	Front
4	2"x4"—12'
2	2"x4"—18'
5	1"x12"—16'
6	1"x4"—16'
	Perches
6	2"x2"—12'
	Windows
4	frames—24"x26" to fit front openings.
	Hardware
4	door latches
1	pair 6" strap hinges for east door
3	pair 4" strap hinges
15	lbs. 8d nails
5	lbs. 16d nails
10'	20" wide 1" mesh poultry netting
	Paint
1	gallon ready mixed house paint.

Brooder Houses Used in Jackson Broiler Producing Area

In broiler producing areas many different type brooder houses are used. The following pictures illustrate the variations found in housing conditions. These pictures were taken in the Jackson broiler producing area.





Death Rate of Chicks As Affected by Floor Area Allowed

The floor space per 100 chicks started averaged 33.2 square feet. The floor space varied from 26 to 80 square feet per 100 chicks started on the farms included in the study. Eighty-three per cent of the lots were produced on floor space ranging from 30 to 60 square feet per 100 chicks started. The death loss averaged 24 per cent for lots produced with less than 30 square feet of floor space per 1-00 chicks started. The death loss was 8.5 per cent for lots produced with 30 to 60 square feet and 7.0 per cent for lots with over 60 square feet of floor space per 100 chicks started.

Mimeograph, "Cost of Producing Broilers in Western Indiana, 1936-1937", Purdue University, Agricultural Experiment Station, Lafayette, Indiana.

Floor Area Per 100 Chicks	Number of Chicks	Chicks Died	Percent Died
35 sq. ft. or less	73,077	19,254	26.3
35-50 sq. ft.	25,371	4,122	16.2
50 sq. ft. or more	25,044	3,484	13.1

California Agriultural Extension Circular 28, "Brooding and Pullet Management", by W. E. Newton and M. W. Buster.

BROODING

Brooding is one of the most important points in broiler production. No matter how good the breeding or how carefully the eggs have been incubated, profitable broilers will not be developed unless they have been well cared for during the brooding period.

Successful chick brooding demands close attention to a few simple details. More careful attention is required the first few days than later, but careful attention is required throughout the brooding period.

Before a group of baby chicks are put in the brooder house it should be cleaned and thoroughly disinfected, repeating this practice after each group of broilers has been marketed.

Brooders: It is advisable to start the brooder stove two or three days before the chicks are put in the house to assure perfect adjustment and safety of the stove. It is unsafe to lay down absolute rules for running a brooder stove. However, most poultrymen regulate the stove to give a thermometer reading of about 90 to 95 degrees when the bulb is two inches from the floor at the edge of the canopy. For brooders that have no canopy, the same temperature should be kept when the thermometer hangs 20 to 30 inches from the edge of the brooder stove. The temperature should be lowered about five degrees each week until about 70 degrees F. is reached and the house kept at this temperature as long as the chicks need artificial heat. The stove is regulated up or down as the case may be when the chicks are placed in the house. First and always the chicks must be comfortable.

The experienced poultryman depends almost entirely upon the action of the chicks in regulating the stove. Chicks pile up or bunch because they are uncomfortable. They may be too warm or too cold, or the floor may be drafty. When they are comfortable and normal the sleeping chicks will lie stretched out on the litter. They will spread out in a circle around the outer edge of the hover in the most comfortable heat area.

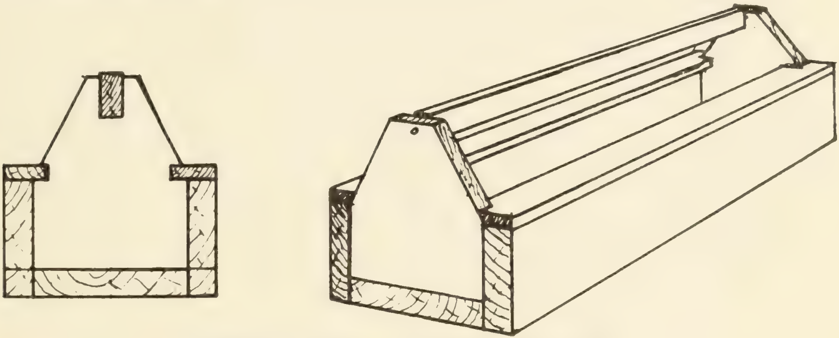
Litter: Where the chicks are brooded on wood or concrete floors it is very essential that some kind of litter be used. The litter should be two or three inches deep over the entire floor of the brooder house. Many kinds of litter are used satisfactorily, including planer shavings, pine needles, peanut hulls, sand, oat or wheat straw, peat moss and ground cane pumice.

Feeding: Chicks hatched on the farm should be fed when they are 24 to 48 hours old. Chicks shipped from a distance should be fed on arrival. Recent experiments have shown that it is safe to feed chicks as soon as they are placed in the brooder house. Chicks hatched on the farm will usually be 24 hours old by the time they are removed from the nest or incubator. The chicks can be fed at intervals or the feed can be left before the chicks from the start. Feed fresh mash each day to stimulate feed consumption. When chicks are about 6 weeks old begin feeding grain in addition to mash.

Water and Milk: Give the chicks as much water or milk as they will drink, beginning with the first feeding. The use of the half-gallon fruit jar, inverted in a small saucer or star top, is one of the most satisfactory ways of supplying water for young chicks under farm conditions. The fountains should be placed on blocks to prevent water or milk from becoming contaminated with dirt and droppings.

During the first few weeks it will be necessary to supply fresh clean water two or three times each day.

Feed Hopper: The type of mash hopper used and the amount of hopper space are important factors in the growth of chicks. To prevent the spread of diseases and parasites, it is highly important that a mash hopper be used which will prevent the chicks from getting in or roosting on it.



A Satisfactory Design for Homemade Chick Feeder

Suggestive Questions

In what condition should the brooder house be when the chicks are put in?

What type brooder stove is best to use?

How should the brooder stove be operated?

When should the brooder stove be started with a group of baby chicks?

What temperature should be maintained in the house?

What is the purpose of litter on the brooder house floor?

When should the chick receive the first feed?

What type feed hopper should be used?

What effect does the number chicks brooded together have on per cent mortality?

Comparison of Different Type Brooders

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Blacksburg, Virginia.

Period: November 21, 1935 to January 30, 1936
February 11, 1936 to April 7, 1936
April 28 to June 23, 1936

Purpose: To compare the different type brooders.

Procedure and Conditions: Six brooder houses approximately 9'x12' in dimensions were used in the tests. The houses were not insulated and they had single thickness tongue and grooved floors. Ventilators were arranged so that the same principle of ventilation was used in all houses.

The same brand and grade of starter and growing mash was used throughout the tests. Feed was kept in the hoppers at all times so that variations in brooding results could not be attributed to the feed.

FIRST SERIES

The following brooders were used in these tests: Commercial electric hover with forced ventilation; commercial electric hover with natural ventilation; kerosene brooder with hover converted for electric operation and natural ventilation; flat top home-made electric brooder; commercial coal brooder; and commercial kerosene brooder.

Twelve hundred Virginia state certified Barred Plymouth Rock chicks were received from the hatchery at 5:00 P. M., November 19, and were placed under the four electric brooders for the night. The kerosene and coal brooders were ready for use the following morning and the chicks were subdivided and 200 were placed under each of the six brooders. Small lights were burned in the coal and kerosene brooder houses at night. After December 9, lights were burned at night in all the electric houses but were not used for the first few weeks because of the danger of attracting the baby chicks from under the hover at night. A tin screen was placed around the electric hovers for the first week to prevent the baby chicks from wandering too far from the hover.

During the ten-week period of this brood the weather was severe. The average outside temperature for the entire period was 29.8° F. The lowest temperature during the period was -7° F. and the highest was 56° F. The only difficulty encountered in the electric brooder houses was that of the water freezing in the drinking fountains on extremely cold nights. A home-made electric warmer was devised using a 25-watt light bulb. One of these warmers placed in each water pan prevented the water from freezing.

SECOND SERIES

In this series of tests the converted electric brooder was omitted, and a new type wood-burning stove was substituted for it. The wood burner consists of a cast iron fire box with a sheet metal canopy. The damper is controlled by a wafer type thermostat and the new feature of the brooder is the specially designed smoke stack which carries a bucket for catching pitch and other wood residues that are deposited in the pipe.

The stock for these tests consisted of 1,000 Barred Plymouth Rock and 200 Rhode Island Red chicks, all Virginia state certified and purchased from the hatchery. The chicks were divided so that an equal number of each breed was placed in each house, making a total of 200 chicks per house. The brooding was started on February 11, and records were kept for a period of eight weeks in the same manner as in the first series of tests. The average outside temperature during this brooding period was 44° F. The maximum temperature was 74° F. and the minimum was 7° F. There was precipitation on 45 per cent of the days, and 61 per cent of the days were cloudy.

THIRD SERIES

The following four types of brooders were used in this series of tests: (1) Natural ventilation commercial electric, (2) wood stove, (3) coal, and (4) kerosene. The electric brooder used in this test was selected from the four electric brooders that had been used in the other tests because it held the best all-round record of operation.

Conditions under which the tests were carried on were such that it was necessary to keep the chicks confined in the brooder house during the entire brooding period. In view of these conditions, the number of chicks alloted to each house was reduced to 150. The stock used for this test came from the same hatchery and consisted of an equal number of virginia state certified Jersey Black Giant, Barred Plymouth Rock and Rhode Island Red chicks. The breeds were all divided equally among the houses in order to assure uniform stock for each house. The maximum outside temperature during this period was 92° F. and the minimum was 37° F. The brooding was started on April 28, and records were kept for a period of eight weeks.

Results: Comparison of Different Types of Brooders

Type Brooder	1st Test—10 Weeks					2nd Test—8 Weeks					3rd Test—8 Weeks				
	No. chicks started	No. chicks reared	% mortality	Av. wt. per chick	Fuel consumed	No. chicks started	No. chicks reared	% mortality	Av. wt. per chick	Fuel consumed	No. chicks started	No. chicks reared	% mortality	Av. wt. per chick	Fuel consumed
Commercial electric with fan	200	191	4.5	1.75	KWH 543	200	175	12.5	1.54	KWH 359					
Commercial electric with natural ventilation	200	181	9.5	1.74	KWH 283	200	162	19.0*	1.42	KWH 251	150	140	6.6	1.61	KWH 132
Converted electric	200	170	15.0	1.77	KWH 533										
Home made electric	200	177	11.5	1.15	KWH 405	200	186	7.0	1.42	KWH 387					
Wood						200	191	4.5	1.40	Cu. Ft. 124	150	143	4.6	1.59	Cu. Ft. 44
Coal	200	185	7.5	1.98	Lbs. 1895	200	193	3.5	1.55	Lbs. 1326	150	139	7.3	1.58	Lbs. 408
Kerosene	200	182	9.0	1.90	Gal. 251	200	184	8.0	1.42	Gal. 132	150	144	5.2	1.72	Gal. 66

*The metal screen was carelessly placed too far from the brooder on the first day of this brood, resulting in a large number of chicks getting too far from the brooder and freezing to death.

The Number of Hours of Labor Required to Operate the Chick Brooders During the Three Series of Tests

Brooder	Changing Litter			Adjusting Temperature Regulator			Supplying fuel, cleaning and removing ashes			Total Number of Hours of labor		
	First Test	Second Test	Third Test	First Test	Second Test	Third Test	First Test	Second Test	Third Test	First Test	Second Test	Third Test
Commercial electric with fan	9	5		1½	1½		0	0		10½	6½	
Commercial electric with natural ventilation	7	5	4	1	1½	1	0	0	0	8	6½	5
Converted electric	7			2			0			9		
Home-made electric	9	5		1½	1½		0	0		10½	6½	
Coal	5	4	4	1	2	1	47½	28	19	53½	34	24
Kerosene	5	4	4	2	2	1½	25½	18	9½	32½	24	15
Wood		4	4		1	1		18*	9½		23	14½

*Does not include cutting or hauling the wood to the brooder house.

A Suggested Form For Calculating Cost for Operating Brooders

	Fuel Cost			Labor Cost at___per hr.			Total Operating Cost		
	First Test	Second Test	Third Test	First Test	Second Test	Third Test	First Test	Second Test	Third Test
Commercial electric with fan									
Commercial electric with natural ventilation									
Converted electric									
Home-made electric									
Kerosene									
Wood									

Reference: Virginia Agricultural Experiment Station Bulletin 306, "Tests of Chick Brooders", pages 2, 3, 4, 5, 6, 7, 8, and 10, tables 1, 2, 3, 4, and 5, November 1936, Blacksburg, Virginia.

The Effect of Confinement Brooding on Growth of Chickens

Conducted by: Kentucky Agricultural Experiment Station.

Conducted at: Lexington, Kentucky.

Period: Ten weeks, beginning April 7, 1931.

Purpose: To study the comparative growth of incubator-hatched White Leghorn chickens brooded and raised according to three methods.

Procedure and Conditions: At the beginning of the experiment, April 7, 1931, 360 one-day-old White Leghorn chicks were divided into three lots and weighed individually. Lot 1, which was to represent normal farm-raised chickens, was raised in a colony brooder house with access to bluegrass range and direct sunlight. Lot 2 was kept during the first three weeks in the battery brooder* with lot 3 and then transferred to the colony brooder house with lot 1. Lot 3 was kept in the battery brooder during the first 22 weeks. The chicks of lot 3, when ten weeks of age, were transferred to compartments 18 inches high, in the same brooder.

All lots received the same ration which consisted of:

	Parts
Wheat bran	25
Wheat middlings	25
Ground yellow corn	25
Meat scrap (50% protein)	12
Dried buttermilk	10
Salt	1
Steamed bone meal	5

Enough of a commercial cod liver oil concentrate (.125% of the mash) was added to protect adequately against rickets. This mash and a grain mixture consisting of equal parts of cracked yellow corn and wheat were before the chickens in hoppers at all times.

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*A five-deck battery brooder, the compartments 3 feet square and 9 to 10 inches high, situated in a basement where it received no direct sunlight.

Results: Bi-Weekly Average Weight of Chicks Alive on the Final Weigh Day (Pounds)

Date	Weeks	Colony brooder raised		Battery brooder raised		Battery brooder raised	
		43 Cockerels	48 Pullets	50 Cockerels	40 Pullets	41 Cockerels	41 Pullets
		Wt. Lbs.	Wt. Lbs.	Wt. Lbs.	Wt. Lbs.	Wt. Lbs.	Wt. Lbs.
April 7	0	.083	.085	.085	.085	.088	.085
April 21	2	.165	.158	.187	.176	.187	.178
May 5	4	.396	.370	.482	.431	.475	.429
May 19	6	.722	.632	.781	.685	.781	.680
June 2	8	1.022	.900	1.068	.940	1.022	.834
June 16	10	1.583	1.328	1.632	1.389	1.748	1.460

Reference: Kentucky Agricultural Experiment Station Bulletin 346, "The Effect of Confinement Brooding on Growth and Egg Production", pages 3, 4, and 5, table 2, January 1934, Lexington, Kentucky.

FEEDING BROILERS

Feeding is one of the most important points that should be considered in the production of broilers. In feeding young chicks it is very necessary that they receive the right kind and amount of feed in order to make a profitable gain. To make a profitable gain chicks require proteins, minerals, carbohydrates and vitamins in their rations. These nutrients should be in proper balance in order to get the growth desired.

Proteins are a very important nutrient in the broiler ration. This nutrient is used for maintenance and development of the chick's body. At least 20% of the body is made up of proteins. There are some protein feeds produced in Mississippi that might be used in a broiler ration. They are cottonseed meal, milk and shrimp meal. The question might be asked, can broiler producers depend on these sources of feed alone to supply the broiler with the needed amount of protein?

Another very important nutrient in the broiler ration is minerals. Minerals are used in the development of bones and determine to a large extent the type of broiler produced. Approximately 4% of the broiler's body is made up of minerals.

Carbohydrates are also important in the broiler ration, but under most conditions this nutrient is supplied in sufficient quantities.

Vitamins have a direct bearing on the development of the young chicks, especially vitamins A, D and G. A ration deficient in vitamin A causes stunted growth and often times a disease similar to roup. The absence of vitamin D prevents proper bone development causing leg weakness and often times rickets. The lack of vitamin G causes loss of weight and stunted growth and often times nutritional paralysis.

As previously stated, in the Jackson broiler producing area all chicks were fed commercial mixed feed. You will notice that this feed contained a wide variety of ingredients, not depending entirely on one source to supply the different nutrients. This fact should be taken into consideration in making a study of this information.

Proteins

What are proteins?

Proteins are nitrogen-bearing compounds composed of carbon, hydrogen oxygen, and sometimes sulphur, phosphorus and iron—a group of nutrients essential to animal life. Proteins vary widely in composition. There are many thousands of different proteins, all of which, however may very probably be broken down by chemical methods to amino acids (about twenty). Certain of these amino acids are referred to as essential, and unless protein contains these essential amino acids they are "incomplete" and will not serve the purpose of the bird completely. One reason why poultrymen should feed a variety of feeds is that a variety of proteins is necessary in order to insure a sufficient amount of essential amino acids.

How does the broiler use protein?

Before the broiler can use the crude protein gotten in feeds the process of breaking these crude proteins down into amino acids must take place. The amino acids are absorbed by the villa of the small intestines, finally passing into the blood stream. They are then carried into the general circulation, and from the blood stream into each of the various tissues of the body, muscles, organs, etc. absorbs a certain amount of the amino acids for growth or the repair of the daily waste of protein matter. The absorbed protein or amino acid which has been transferred to the tissues of the body may be oxidized or burned to warm the animal or to produce energy to carry on the vital processes. The amino acids may be built up into body protein or if not needed for this purpose a portion of their carbon, hydrogen or oxygen may be converted into fat. However, nitrogen is excreted chiefly in the form of urea. The highest use of the proteins, however, is the formation of nitrogenous tissues, the muscles, nerves, skin and various organs of the body.

Suggestive Questions

What protein feeds are produced on the farms of Mississippi that are suitable to use in feeding broilers?

Will cottonseed meal supply the necessary protein in the broiler ration?

Does cottonseed meal have a harmful effect on broilers?

What source of protein should be used in feeding broilers?

What percentage of protein should a broiler ration contain?

As the chicks grow older is it possible to reduce the protein content of the feed by substituting a lower protein feed?

Protein Requirements for Chickens

Conducted by: New Hampshire Agricultural Experiment Station.

Contducted at: Durham, New Hampshire.

Period: 12 weeks, started April 4, 1935.

Purpose: To determine (1) optimum levels of protein intake for chickens during their various stages of growth, and production, (2) efficient sources of protein and (3) the most efficient combinations of sources for the various growth periods studied.

Procedure and Conditions: In Test 1, twelve groups of 20 New Hampshire chicks were started April 4, 1935, and raised in growing batteries up to 12 weeks of age. In Test 2 twelve groups of 60 New Hampshire chicks were started April 7, 1937. The groups were fed various protein-carrying rations as outlined below:

Percentage content of protein, calcium, phosphorus and ash in protein concentrates and basal ration

Ingredients	Protein		Calcium	Phosphorus	Ash
	Test 1	Test 2	Test 2	Test 2	Test 2
Fish meal	57.23	62.00	7.89	4.08	23.05
Meat scraps	55.62	55.34	8.88	4.34	26.56
Dried skimmilk	33.58	38.09	1.58	1.03	7.93
Basal ration	13.09	12.56	1.54	.54	6.78

Groups 1, 2 and 3: basal ration plus meat scraps to make 15, 17 and 19 per cent protein content, respectively.

Groups 4, 5, and 6: basal ration plus white fish meal, vacuum processed, to make 15, 17 and 19 per cent protein content, respectively.

Groups 7, 8, and 9: basal ration plus dried skimmilk to make 15, 17 and 19 per cent protein content respectively.

Groups 10, 11, and 12: basal ration plus a combination of the three animal protein sources in equal protein-carrying amounts to make 15, 17 and 19 per cent protein content respectively.

The basal ration was composed of 200 pounds yellow corn meal, 100 pounds wheat bran, 100 pounds white flour middlings, 100 pounds ground heavy oats, 25 pounds alfalfa leaf meal, 15 pounds oyster shell flour, 5 pounds salt and 3 pounds biologically tested sardine oil. All groups in both Test 1 and 2 were fed this ration plus specified protein in an all-mash form throughout the experimental procedure.

In Test 1 all chicks used were indivdually wing-banded and weighed weekly throughout the experimental period of 70 weeks. In Test 2 average group weights were recorded up to time of placement in laying cages. Individual bi-monthly weights were recorded from this period to the end of the test. Feed consumption records in Test 1 were determined weekly by groups throughout the first 12 weeks of the experimental period. In Test 2 feed consumption records were maintained throughout the experimental period on a group basis weekly.

Protein Concentrates Used: Meat Scraps used in the two tests were made from butcher shop and packers' trimmings. The product at the time of purchase was not over ten days old, but complete history of its manufacture together with percentage amounts of its component parts could not be secured.

Dried skimmilk was made by the roller process and was received within one week of the date of manufacture.

The **fish meal** used in the tests is commonly termed vacuum-processed white fish meal. It was made from fish that were caught one day and processed the following day. The product produced contained several varieties of fish but consisted largely of cod and haddock. The raw product was ground, cooked and pressed previous to being placed into the dehydrator. The product was dehydrated at a 26"-27" vacuum at an inside temperature of approximately 120° Fahrenheit.

Summary of Weight Records in Pounds Per Bird by Stated Weekly Periods for Meat Scrap Groups

Age	Group 1		Group 2		Group 3	
	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1 day	.0916	.0885	.0946	.0923	.0940	.0923
4 weeks	.4617	.3911	.5324	.4538	.5770	.4788
8 weeks	1.392	1.161	1.437	1.270	1.546	1.354
12 weeks	2.448	2.200	2.600	2.416	2.758	2.348
Feed consumed per chick	10.713	8.355	11.124	9.001	9.335	9.574

Summary of Weight Records in Pounds Per Bird by Stated Weekly Periods for Fish Meal Groups

Age	Group 4		Group 5		Group 6	
	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1 day	.0936	.0923	.0920	.0923	.0946	.0884
4 weeks	.4934	.4745	.5320	.4961	.5900	.5287
8 weeks	1.364	1.480	1.560	1.484	1.647	1.592
12 weeks	2.429	2.721	2.797	2.750	2.780	2.798
Feed consumed per chick	10.379	9.822	11.201	8.969	10.474	9.694

Summary of Weight Records in Pounds Per Bird by Stated Weekly Periods for Dried Skimmilk Groups

Age	Group 7		Group 8		Group 9	
	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1 day	.0933	.0884	.0923	.0923	.0910	.0923
4 weeks	.4748	.4325	.4966	.4570	.5392	.4637
8 weeks	1.308	1.125	1.403	1.000	1.511	1.153
12 weeks	2.293	2.167	2.645	2.222	2.805	1.913
Feed consumed per chick	9.917	7.755	10.238	8.401	11.544	7.345

Summary of Weight Records in Pounds Per Bird by Stated Weekly Periods for Protein Mixture Groups

Age	Group 10		Group 11		Group 12	
	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2
1 day	.0923	.0923	.0933	.0846	.0916	.0884
4 weeks	.4739	.4041	.5741	.4827	.6067	.5040
8 weeks	1.413	1.241	1.543	1.525	1.657	1.508
12 weeks	2.714	2.339	2.890	2.777	2.961	2.846
Feed consumed per chick	10.484	8.952	10.856	10.019	11.481	10.061

Reference: New Hampshire Agricultural Experiment Station Bulletin 312, "Protein Requirements of Chickens at Various Stages of Growth and Development", pages 3, 4, 5, 6, 7, 8, 9 and 10, tables 1, 3a, 3b, 3c, and 3d, 4a, 4b, 4c, and 4d, May 1939 Durham, New Hampshire.

Protein Levels for Broiler Production

Conducted by: Delaware Agricultural Experiment Station.

Conducted at: Newark, Delaware.

Period: 11 weeks, December 1, 1937 through February 15, 1938.

Purpose: To determine protein levels for broiler production.

Procedure and Conditions: The chicks used in the experiment were hatched on November 30, 1937 and placed in the brooder house December 1, 1937. Eight hundred and twenty-eight crossbred chicks, obtained by crossing Barred Plymouth Rock males and Rhode Island Red females were delivered by the hatchery on December 1. These chicks were then divided into four groups of 207 chicks and placed in the experimental pens.

The chicks were brooded in an open front, shed roof long brooder house in pens 10 by 14 feet. Each pen was provided with a 10 by 12 feet concrete sunporch. The brooder pen floors were of concrete and a sugar cane by-product and peanut hulls were used as litter. Shredded corn stover was spread over the concrete sunporch to encourage the broiler chicks to make use of the porch when weather permitted.

Each pen was provided with a coal burning brooder stove with a 56-inch hover. Water was provided in each pen by automatic fountains.

The broilers were group weighed bi-weekly until the end of the eleventh week when they were individually weighed. Individual weights were obtained at the end of the twelfth, thirteenth, and fourteenth week of those broilers remaining in the pens.

The feed was fed as all-mash rations and was kept before the broilers at all times. All feed was weighed as it was placed in the pens and any feed remaining in the hoppers when the broilers were weighed was weighed back. Chick size oyster shell and granite grit were available to the broilers through the experiment.

The tabulation given below shows the rations fed during the experiment.

Formulas for Rations and Compositions

Ingredients	Ration and Lot No.			
	1	2	3	4
	Per cent	Per cent	Per cent	Per cent
Ground yellow corn	43.1	40.1	37.3	34.4
Wheat bran	14.4	13.3	12.4	11.4
Flour wheat middlings	14.4	13.3	12.4	11.4
Ground oat groats	10.7	10.0	9.3	8.6
Meat scraps (55%)	6.5	10.0	13.8	17.2
Dried buttermilk	4.3	6.7	9.2	11.4
Alfalfa leaf meal	4.7	4.7	4.7	4.7
Steamed bone meal	1.0	1.0		
Salt	0.7	0.7	0.7	0.7
Cod liver oil (Conc.)	0.2	0.2	0.2	0.2
Totals	100.0	100.0	100.0	100.0
Percent protein	16.3	18.3	20.4	22.3
Percent fiber	4.2	3.9	3.8	3.6
Percent ash	5.5	6.3	6.7	7.6

Results: Average Weight of Broilers Bi-weekly for 11 Weeks.

Weeks	16.3 Per cent	18.3 Per cent	20.4 Per cent	22.3 Per cent
	Pounds	Pounds	Pounds	Pounds
Initial	0.078	0.077	0.078	0.077
2	0.198	0.221	0.250	0.249
4	0.476	0.546	0.604	0.526
6	0.904	0.995	1.110	1.042
8	1.389	1.538	1.562	1.581
10	1.856	2.063	2.095	2.117
11	2.207	2.397	2.439	2.469

Pen No.	1	2	3	4
Protein level, in per cent	16.3	18.3	20.4	22.3
Original No. of chicks	207	207	207	207
Final No. of broilers	202	199	199	190
Average No. of broilers	205.3	200.1	201.6	198.0
Per cent mortality	2.4	3.9	3.9	8.2
Number of days on feed	77	77	77	77
Initial av. weights, lbs.	0.078	0.077	0.078	0.077
Final av. weights, lbs.	2.207	2.397	2.439	2.469
Av. gain per broiler, lbs.	2.129	2.320	2.361	2.392
Feed consumed per pen, lbs.	1649.75	1682.75	1715.31	1675.00
Av. feed consumed per broiler, lb.	8.06	8.42	8.51	8.46
Lbs. feed required per pound gain	3.78	3.63	3.60	3.69

Reference: Delaware Agricultural Experiment Station Bulletin 210, "Broiler Feeding Experiments", pages 5, 6, 7 and 10, tables 1, 2 and 4, June 1938, Newark, Delaware.

The Comparative Effect of Various Proteins for Growing Chicks

Conducted by: Washington Agricultural Experiment Station.

Conducted at: Pullman, Washington.

Period: 14 weeks, beginning April, 1933.

Purpose: To determine the comparative efficiency of Alaska herring fish meal, skimmilk powder, high grade meat scrap (56 per cent protein), and Manchurian soybean meal for growing chicks.

Procedure and Conditions: This experiment was started in April 1933, with 800 Single Comb White Leghorn Pullorum-free chicks. They were carefully selected for uniformity of health, vigor, and weight, and divided into eight lots of 100 chicks each.

The chicks were brooded in a brooder house 16'x200', divided into eight 10'x11' pens. Each lot was supplied with 100 square feet of wire sunporch, and the sunporches were available for the use of the birds in these pens when the weather permitted. Each brooding compartment was equipped with a 200-chick electric brooder. The chicks were brooded on wire frames the first eight weeks. Wasteproof hoppers with wire grids were supplied in each pen.

The formulas of the rations will be found in the table that follows. Each of the four protein concentrates were fed at levels of approximately 13 to 16 per cent protein. All rations were balanced at a level of approximately 1.6 per cent calcium and 0.8 per cent phosphorus. Sufficient vitamin D was supplied by the addition of one-fourth per cent of concentrated cod liver oil to the ration. These rations were fed as all-mash rations to the growing pullets from the age of two days to 14 weeks inclusive.

The chicks were individually weighed bi-weekly. All the cockerels were removed from each lot at eight weeks of age. All the data reported herein applied to pullets. A record was kept of their mortality and feed consumption.

Rations

Lot No.	1	2	3	4	5	6	7	8
Per cent Protein	13	16	13	16	13	16	13	16
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Basal	85.54	81.02	78.52	65.75	85.34	80.48	81.70	72.66
Dehydrated alfalfa	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Salt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Oyster shell flour	1.85	1.98	1.73	1.73	1.70	1.55	1.75	1.75
Bone meal	2.10	1.42	2.15	1.54	1.36	0.00	2.55	2.40
Cod liver oil	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Herring fish meal	4.26	9.33						
Skimmilk powder			11.35	24.73				
Meat scrap					5.35	11.72		
Manchurian soybean meal							7.75	16.94
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Results: Feed Consumed and Weight of Pullets Bi-Weekly for 14 Weeks

Lot No.	1		2		3		4		5		6		7		8	
Protein Level in Per Cent	13		16		13		16		13		16		13		16	
Kind of Protein	Alaska herring fish meal		Alaska herring fish meal		Skimmilk powder		Skimmilk powder		Meat scrap (56% prot.)		Meat scrap (56% prot.)		Soybean meal		Soybean meal	
	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.
0		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08
2	0.31*	0.14	0.38	0.15	0.36	0.14	0.45	0.15	0.34	0.14	0.34	0.15	0.34	0.14	0.31	0.13
4	0.78	0.32	0.91	0.38	0.39	0.33	0.99	0.37	0.34	0.32	0.81	0.33	0.75	0.27	0.75	0.26
6	0.93	0.58	1.00	0.70	0.96	0.58	1.03	0.65	0.94	0.61	1.06	0.73	0.43	0.43	0.67	0.40
8	1.46	0.97	1.51	1.12	1.46	0.94	1.74	1.06	1.72	1.00	1.64	0.95	1.10	0.66	1.06	0.60
10	1.71	1.39	1.87	1.59	1.94	1.32	1.77	1.50	1.74	1.40	1.62	1.40	1.39	0.95	1.26	0.82
12	1.95	1.76	1.92	1.93	1.70	1.69	2.14	1.87	1.99	1.87	1.92	1.76	1.54	1.23	1.62	1.10
14	2.01	2.06	1.95	2.25	1.90	2.00	2.06	2.17	2.07	2.17	1.87	2.08	1.70	1.53	1.62	1.38

*Wt. for 1-3 weeks

Reference: Washington Agricultural Experiment Station Bulletin 321, "The Comparative Efficiency of Various Proteins for Growing Chicks", pages 5, 7, 8, 9 and 10, tables 2 and 4, August 1935, Pullman, Washington.

The Comparative Effect of Various Proteins for Growing Chicks

Conducted by: Washington Agricultural Experiment Station.

Conducted at: Puyallup, Washington.

Period: 14 weeks.

Purpose: To compare various protein feeds for growing chicks.

Procedure and Conditions: The experiment was started in April 1933 with 1200 Single Comb White Leghorn, Pullorum-free chicks. They were divided into eight lots of 150 chicks each, carefully selected for uniformity of health, vigor, and weight.

The chicks were brooded in a brooder house 20'x120', divided into eight 15'x20' pens. All lots of chicks were supplied with a sunporch which was available when the weather permitted. Similar equipment and methods of brooding were used as is described in the experiment run at Pullman, Washington.

The formulas for the rations will be found in the table that follows. Each lot was fed an all-mash ration with a protein level of approximately 16 per cent. The same levels of calcium, phosphorus, and vitamin D were used in these rations as were used in the Pullman experiment.

The chicks were individually weighed bi-weekly. All of the data reported herein applied to pullets, the cockerels being removed at six weeks of age.

Formulas for Rations

Lot No.	1	2	3	4	5	6	7	8
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Basal	81.20	77.33	74.49	80.98	77.85	75.98	79.18	77.69
Dehydrated alfalfa	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Salt	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Oyster shell flour	2.08	2.00	2.00	1.93	2.00	2.00	2.00	2.00
Bone meal	1.41	1.86	1.42	0.63	1.00	1.61	1.20	1.27
Cod liver oil	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Herring fish meal	9.31	4.92	5.15	4.70	4.92	5.03	4.81	4.92
Skimmilk powder			10.94		5.22	5.34		3.48
Meat scrap				5.76	3.01		2.95	2.01
Manchurian soybean meal		7.89				4.04	3.86	2.63
Total	100.25	100.25	100.25	100.25	100.25	100.25	100.25	100.25

Results: Feed Consumed and Weight of Pullets Bi-Weekly for 14 Weeks.

Lot No.	1		2		3		4		5		6		7		8	
Protein Level in Per cent	16		16		16		16		16		16		16		16	
Kind of Protein	Alaska herring fish meal		Alaska herring fish meal & soybean meal		Herring meal and skimmilk		Herring meal and meat scrap		Herring meal skimmilk powder and meat scrap		Herring meal skimmilk powder and soybean meal		Herring meal meat scrap & soybean meal		Herring meal skimmilk, meat scrap, soybean meal	
Weeks	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.	Wt. of feed Lbs.	Wt. of chick Lbs.
0		0.08		0.08		0.08		0.08		0.08		0.08		0.08		0.08
2	0.59	0.18	0.53	0.18	0.57	0.19	0.52	0.18	0.55	0.19	0.55	0.19	0.52	0.16	0.53	0.18
4	0.70	0.38	0.77	0.36	0.89	0.43	0.74	0.37	0.79	0.39	0.84	0.42	0.76	0.35	0.87	0.43
6	1.77	0.71	1.32	0.67	1.36	0.80	1.15	0.70	1.24	0.76	1.24	0.80	1.19	0.67	1.38	0.80
8	1.54	1.04	1.48	0.98	1.64	1.14	1.56	1.04	1.55	1.12	1.55	1.16	1.51	0.98	1.66	1.15
10	1.62	1.41	1.56	1.29	1.77	1.54	1.68	1.41	1.73	1.50	1.68	1.51	1.61	1.32	1.75	1.52
12	1.89	1.81	1.88	1.72	1.93	1.92	1.87	1.82	1.92	1.91	1.89	1.89	1.86	1.71	1.90	1.93
14	2.07	2.17	2.05	2.10	2.16	2.36	2.12	2.20	2.13	2.27	2.15	2.25	2.09	2.09	2.18	2.26

Reference: Washington Agricultural Experiment Station Bulletin 321, "The Comparative Efficiency of Various Proteins for Growing Chicks", pages 18, 19, and 22, August 1935, Pullman, Washington.

Cottonseed Meal in Chick Rations

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson, South Carolina.

Period: 1937.

Purpose: To determine the use and value of cottonseed meal in starting and growing rations for chickens.

Procedure and Conditions: This test consisted of two experiments each run in duplicate.

First Experiment. In this experiment cottonseed meal was used to replace one-fourth, one-half, and three-fourths, respectively, of the meat scrap protein in the chick ration. Ample quantities of dried whey and alfalfa leaf meal were included to provide sufficient vitamin G. Vitamin D was supplied by a cod-liver concentrate. Calcium carbonate was added to supply the deficiency of cottonseed meal in this element. A chick starting ration containing dried milk and alfalfa leaf meal as commonly recommended by the station was included in the trials as a further check on the results obtained. All rations contained approximately 18 per cent protein.

Twenty-five day-old Single Comb White Leghorn chicks were used in each pen. The chicks were brooded in individually heated battery brooders for the first four weeks, then transferred to wire-floored pens in a heated room for the remainder of the eight week period. The ration was fed as an all-mash, which along with water, was kept before the birds at all times.

Second Experiment. The second experiment was conducted to determine the amount of vitamin G carriers required to supplement the chick starting ration when cottonseed meal is used to replace one-half of the protein from meat scraps. The same type of chicks brooded under similar conditions was used in this experiment except only 20 chicks per pen were used in the first trial. Variations in the vitamin G content of the ration were made through the use of different amounts of dried whey. A standard starting ration containing 10 per cent dried milk and 5 per cent alfalfa leaf meal was used for comparison.

Results: Rations, Growth and Mortality of Chicks When Cottonseed Meal Replaced Varying Proportions of Meat Scraps

EXPERIMENT I

	Pen Number				
Ingredients	1	2	3	4	5
Pounds of Ingredients in 100 Pounds Ration					
Yellow corn meal	49.77	42.01	41.13	38.89	36.65
Wheat middlings	25.00	25.00	25.00	25.00	25.00
Meat scrap, 50% protein	18.48	19.74	14.81	10.04	5.08
Cottonseed meal, 41% protein			5.81	11.82	18.02
Dried skimmilk	3.00				
Dried whey		7.50	7.50	7.50	7.50
Alfalfa leaf meal, dehydrated	3.00	5.00	5.00	5.00	5.00
Steamed bone meal				1.00	2.00
Salt	0.50	0.50	0.50	0.50	0.50
Cod-liver oil, concentrate	0.25	0.25	0.25	0.25	0.25

Summary of Results After Eight Weeks

Average weight per chick Pounds:					
Trial 1	1.2	1.2	1.4	1.3	1.3
Trial 2	1.3	1.2	1.4	1.3	1.2
Lbs. feed required per pound gain:					
Trial 1	3.52	3.80	3.48	3.68	3.84
Trial 2	3.50	3.71	3.47	3.81	4.12
Mortality, number:					
Trial 1	1	2	0	0	0
Trial 2	1	0	0	0	2

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EXPERIMENT II

	Pen Number						
Ingredient	1	2	3	4	5	6	7
	Pounds of Ingredients in 100 Pounds Ration						
Yellow corn meal	45.38	50.22	46.60	44.60	42.60	41.07	39.07
Wheat middlings	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Meat scrap, 50% protein	13.87	10.72	10.08	10.08	10.08	9.86	9.86
Cottonseed meal, 41% protein		12.31	11.57	11.57	11.57	11.32	11.32
Dried skimmilk	100.00						
Dried whey				2.00	4.00	6.00	8.00
Alfalfa leaf meal, dehydrated	5.00		5.00	5.00	5.00	5.00	5.00
Oyster shell meal		1.00	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Cod-liver oil, concentrate	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Summary of Results After Eight Weeks

Average weight per chick Pounds:							
Trial 1	1.5	1.1	1.3	1.3	1.4	1.4	1.3
Trial 2	1.4	0.9	1.1	1.2	1.3	1.3	1.3
Lbs. feed required per pound gain:							
Trial 1	3.15	3.61	3.42	3.48	3.37	3.44	3.79
Trial 2	3.57	4.37	3.88	3.68	3.73	3.79	4.07
Mortality, number:							
Trial 1	0	0	1	1	0	1	0
Trial 2	0	0	0	0	0	0	0

50th An. Rpt., S. C. Exp. Sta.

Reference: Agricultural Education Vol. 15, No. 4, pages 51, 52, 53, tables 2 and 3, December 1938, Clemson, S. C.

Cottonseed Meal Compared with Shrimp Meal as Source of Protein

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: Spring and summer, 1938.

Purpose: To compare cottonseed meal with shrimp meal as a source of protein.

Procedure and Conditions: Two tests were conducted for a period of eight weeks, one being replica. The first test began April 18, 1938, the second June 15, 1938. The tests were conducted in battery brooders, with thirty chicks to the lot. In each test, lot 1 was fed State College Starting Mash, lot 2 the same except 13 lbs. of shrimp meal was replaced with cottonseed meal.

Rations for Lot 1	Rations for Lot 2
40 lbs. corn meal (white)	40 lbs. corn meal (white)
7 lbs. wheat shorts	7 lbs. wheat shorts
10 lbs. wheat bran	10 lbs. wheat bran
13 lbs. shrimp meal	13 lbs. cottonseed meal
5 lbs. alfalfa leaf meal	5 lbs. alfalfa leaf meal
10 lbs. ground oats	10 lbs. ground oats
5 lbs. dried milk	5 lbs. dried milk
½ lb. cod liver oil	½ lb. cod liver oil
½ lb. salt	½ lb. salt
Oyster shell flour ad libitum	Oyster shell flour ad libitum

Results: To show the effect of date of hatch on growth, data of each test will be given separately, as well as the average.

Average Weights and Feed Consumption by Weeks—First test of chicks completing test. Lot 1, 26 chicks; Lot 2, 23 chicks

Weeks	Start	1	2	3	4	5	6	7	8	
Lot 1, weight in ounces	1.44	2.73	3.93	5.24	8.08	11.34	15.38	18.80	21.80	
Lot 2, weight in ounces	1.44	2.39	3.71	4.80	7.37	8.50	12.82	14.65	18.00	
Lot 1, feed in lbs. per chick		.125	.250	.346	.385	.544	.799	.862	.951	Total feed 4.262

Average Weights and Feed Consumption by Weeks—Second Test of chicks completing test. Lot 1, 24 chicks; Lot 2, 24 chicks

Weeks	Start	1	2	3	4	5	6	7	8	
Lot 1, weight in ounces	1.50	1.99	2.99	3.95	6.18	9.32	12.94	14.44	18.90	
Lot 2, weight in ounces	2.07	2.19	2.66	2.50	6.75	6.48	9.12	10.27	12.70	
Lot 1, feed in lbs. per chick		.094	.156	.276	.290	.500	.590	.885	.880	Total feed 3.671
Lot 2, feed in lbs. per chick		.140	.150	.250	.302	.380	.550	.600	.630	Total feed 3.002

Average Weight and Feed Consumption by Weeks—Tests 1 and 2 Combined

Weeks	Start	1	2	3	4	5	6	7	8	
Lot 1, weight in ounces	1.46	2.37	3.48	4.62	7.168	10.47	14.20	16.71	20.39	
Lot 2, weight in ounces	1.76	2.29	3.17	3.62	7.05	7.47	10.93	12.41	14.80	
Lot 1, feed in lbs. per chick		.11	.205	.312	.337	.537	.700	.870	.917	Total feed 3.988
Lot 2, feed in lbs. per chick		.160	.190	.290	.340	.480	.610	.730	.730	Total feed 3.530

Reference: Unpublished information of Poultry Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

Cottonseed Meal, Shrimp Meal and Meat Scrap As Protein Supplements for Growing Chicks in Mississippi

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: 8 weeks.

Purpose: To compare cottonseed meal, shrimp meal and meat scrap as protein supplements for growing chicks.

Procedure and Conditions: There were 28, 5 day old chicks in each of the three groups in the test.

During the first 6 weeks of the test the chicks were fed the following rations:

Cottonseed Meal Ration	Shrimp Meal Ration	Meat Scrap Ration
34½ lbs. yellow corn meal	37½ lbs. yellow corn meal	37½ lbs. yellow corn meal
10 lbs. wheat shorts	10 lbs. wheat shorts	10 lbs. wheat shorts
10 lbs. wheat bran	10 lbs. wheat bran	10 lbs. wheat bran
5 lbs. alfalfa meal	10 lbs. ground oats	10 lbs. ground oats
10 lbs. ground oats	5 lbs. alfalfa leaf meal	5 lbs. alfalfa leaf meal
7½ lbs. dried milk	7½ lbs. dried milk	7½ lbs. dried milk
22 lbs. cottonseed meal	5 lbs. cottonseed meal	13 lbs. meat scraps
2½ lbs. oyster shell flour	1 lb. bone meal	5 lbs. cottonseed meal
1 lb. bone meal	13 lbs. shrimp meal	½ lb. salt
½ lb. salt	½ lb. salt	½ lb. cod liver oil
½ lb. cod liver oil	½ lb. cod liver oil	

At the age of 6 weeks the rations were changed to the following growing mash:

Cottonseed Meal Ration	Shrimp Meal Ration	Meat Scrap Ration
55½ lbs. yellow corn meal	58 lbs. yellow corn meal	58 lbs. yellow corn meal
7 lbs. wheat shorts	7 lbs. wheat shorts	7 lbs. wheat shorts
7 lbs. wheat bran	7 lbs. wheat bran	7 lbs. wheat bran
14½ lbs. cottonseed meal	8½ lbs. shrimp meal	8½ lbs. meat scrap
4½ lbs. alfalfa leaf meal	4½ lbs. alfalfa leaf meal	4½ lbs. alfalfa leaf meal
6½ lbs. ground oats	6½ lbs. ground oats	6½ lbs. ground oats
5 lbs. dried milk	3½ lbs. cottonseed meal	3½ lbs. cottonseed meal
3 lbs. oyster shell flour	5 lbs. dried milk	5 lbs. dried milk
½ lb. bone meal	1 lb. oyster shell flour	1/3 lb. oyster shell flour
½ lb. salt	½ lb. salt	½ lb. salt
½ lb. cod liver oil	½ lb. cod liver oil	½ lb. cod liver oil

In the cottonseed meal group 3 chicks died of nutritional paralysis.

Two chicks died in the meat scrap group during the test.

The group receiving the shrimp meal had one chick to die and one chick was killed.

Results: Feeding Cottonseed Meal, Shrimp Meal and Meat Scrap as Protein Supplement

Ration	Initial Weight	Weight 1st Wk.	Weight 2nd Wk.	Weight 3rd Wk.	Weight 4th Wk.	Weight 5th Wk.	Weight 6th Wk.	Weight 7th Wk.	Weight 8th Wk.	Total
Weight of chick (ounces)										
Cottonseed meal	2.5	3.134	4.718	5.415	10.17	13.08	15.04	17.86	20.8	
Shrimp meal	2.41	3.13	4.83	6.91	10.09	14.16	18.92	23.02	28.13	
Meat scrap	2.5	2.8	3.9	5.4	8.6	12.27	16.9	20.86	26.82	
Feed consumed by weeks and total (pounds) for 28 chicks										
Cottonseed meal		4.5	7.0	10.6	14.4	19.85	21.07	24.0	21.5	122.92
Shrimp meal		3.75	8.85	11.85	16.6	19.85	26.13	29.2	31.0	147.23
Meat scrap		3.5	6.07	8.07	14.4	17.75	22.75	26.7	28.2	127.44

Reference: Unpublished information from the Poultry Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

Cottonseed Meal, Shrimp Meal and Meat Scrap as Protein Supplement for Producing Broilers

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: 8 weeks, beginning April 4, 1939.

Purpose: To compare cottonseed meal, shrimp meal and meat scrap as protein supplement for producing broilers.

Procedure and Conditions: Three pens of 30 chickens each were selected for this test. The rations were calculated as near as possible on the same weight basis and in all cases at the end of the 6th week the dried milk was cut to five pounds, and other protein reduced equally to lower level.

The following rations were fed each pen:

Cottonseed meal Ration	Shrimp Meal Ration	Meat Scrap Ration
34½ lbs. yellow corn meal	38½ lbs. yellow corn meal	38½ lbs. yellow corn meal
10 lbs. wheat shorts	10 lbs. wheat shorts	10 lbs. wheat shorts
10 lbs. wheat bran	10 lbs. wheat bran	10 lbs. wheat bran
5 lbs. alfalfa meal	10 lbs. ground oats	10 lbs. ground oats
10 lbs. ground oats	5 lbs. alfalfa leaf meal	5 lbs. alfalfa leaf meal
7½ lbs. dried milk	7½ lbs. dried milk	7½ lbs. dried milk
22 lbs. cottonseed meal	17 lbs. shrimp meal	17 lbs. meat scrap
2½ lbs. oyster shell flour	½ lb. salt	½ lb. salt
1 lb. bone meal	½ lb. cod liver oil	½ lb. cod liver oil
½ lb. salt		

In the cottonseed meal group two chicks developed nutritional paralysis.

The meat scrap group eleven chickens developed slipped tendons with 17% level of meat scrap which points out that the mineral matter was unbalanced or excessive.

Results: Feeding Cottonseed Meal, Shrimp Meal and Meat Scrap as Protein Supplement

Ration	Initial Weight	Weight 1st Wk.	Weight 2nd Wk.	Weight 3rd Wk.	Weight 4th Wk.	Weight 5th Wk.	Weight 6th Wk.	Weight 7th Wk.	Weight 8th Wk.	Total
Weight of Chicks (ounces)										
Cottonseed meal	1.61	2.16	3.52	5.64	8.20	11.56	15.96	20.67	25.93	
Shrimp meal	1.58	2.12	3.62	5.74	8.85	12.16	17.46	21.91	26.66	
Meat scrap	1.49	2.23	3.38	5.09	7.72	11.12	14.67	18.09	21.2	
Feed Consumed by Weeks and Total (pounds) for 30 Chicks										
Cottonseed meal		3.1	6.3	10.4	13.3	18.5	19.6	28.0	27.6	126.33
Shrimp meal		3.5	5.6	9.3	13.4	19.5	21.0	28.9	29.6	130.17
Meat scrap		2.2	5.5	8.7	13.4	17.1	19.2	25.3	22.3	113.65

Reference: Unpublished information of the Poultry Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

A Comparison of the Nutritive Values of Cottonseed Meal, Alfalfa Leaf Meal and Meat and Bone Scraps in a Ration for Growing Chicks

Conducted by: New Mexico Agricultural Experiment Station.

Conducted at: State College, New Mexico.

Period: 3 years, 1930, 1931 and 1932.

Purpose: To study the comparative value of the three feeds cottonseed meal, alfalfa leaf meal, and meat and bone scraps.

Procedure and Conditions: The chicks used in this test were Single Comb White Leghorns hatched from the Experiment Station's breeding flocks. They were brooded in colony type brooder houses around colony house style brooder stoves. The chicks were weighed on the second day after hatching, before being placed in the brooder, again on the seventh day, and at weekly intervals thereafter until they were 8 weeks old. From 8 weeks on, only the pullets were kept in the experiment and they were weighed every four weeks until they were 24 weeks old.

The chicks were kept on the starting rations until they were 8 weeks old, at which time they were changed to the growing rations, which ration for each pen was of the same nature as the starting ration for that particular pen. At 24 weeks of age the pullets were all housed in the same laying house and all given the standard laying ration used at this Station. Their trap nest records were kept during their first laying year, in order to learn whether or not the starting and growing ration given each pen exerted any influence on the pullet's production.

The method followed in preparing the different rations and in conducting the test was one developed by the Bureau of Animal Industry of the United States Department of Agriculture in connection with several of the Southwestern agricultural experiment stations. This method of procedure, called the "Uniform Method", is planned to provide a basal ration which is complete in all essential nutrients and in which substitutions of the feed being studied may be made without effecting the results obtained in any way, other than the difference produced by the feed which is being tested. To accomplish this, the basal ration is well supplied with the various food nutrients, vitamins, and minerals, from a variety of sources. Substitutions of the feeds being studied are made in the basal ration without materially changing the value of the ration in any other way. For example: the variety of feeds in the ration is not changed by the substitution. The vitamin and mineral requirements are still adequately provided for, the difference in the total amount of protein, carbohydrates, or fats supplied is slight. In order that the results obtained may be more easily compared, the method recommends that all pens be fed the same amount. To accomplish this, it was necessary to feed the chicks a limited amount of feed each day instead of supplying it to them ad libitum. In this test the pens were fed approximately 85 per cent of the amount which they would normally have consumed if fed ad libitum.

During the brooding season of 1930 a number of chicks developed a peculiar form of leg weakness. This type of leg weakness is, apparently, caused by lack of balance among the nutrients and minerals in the ration. The ration seemed to contain more phosphorus in proportion to calcium than it should, giving it a calcium-phosphorus ratio which was too narrow. A wider calcium-phosphorus ratio was obtained by replacing the steamed bone-meal with 2 pounds of fine oyster shell.

The following table gives the starting mash given each pen in 1931 and 1932. These rations have been slightly changed since 1930.

Formulas for the Starting Mash Given Each Pen in 1931 and 1932

Feeds	Pen 1 Basal Ration	Pen 2	Pen 3	Pen 4	Pen 5
	Pounds	Pounds	Pounds	Pounds	Pounds
Yellow corn meal	40.00	40.0	40.0	40.0	40.0
Wheat bran	13.0	13.0	13.0	13.0	13.0
Rice bran	10.0	10.0	10.0	10.0	10.0
Corn gluten meal	10.0		10.0		10.0
Dried buttermilk	10.0	10.0	10.0	10.0	10.0
Meat and bone scraps	10.0	10.0		10.0	
Cottonseed meal		10.0	10.0		
Alfalfa leaf meal				10.0	10.0
Fine oyster shell	4.2	4.2	4.2	4.2	4.2
Cod liver oil	2.0	2.0	2.0	2.0	2.0
Salt	0.8	0.8	0.8	0.8	0.8

At 8 weeks of age the cockerels were removed from the flock, leaving the pullets to continue in the experiment. At this time they were changed to growing rations, the formulas for which are given in the table below.

Growing Mash Rations Fed Each Group from 8 Weeks to 24 Weeks of Age

Feeds	Pen 1 Basal Ration	Pen 2	Pen 3	Pen 4	Pen 5
Mash	Pounds	Pounds	Pounds	Pounds	Pounds
Yellow corn meal	40.0	40.0	40.0	40.0	40.0
Ground wheat	25.0	25.0	25.0	25.0	25.0
Corn gluten meal	10.0		10.0		10.0
Cottonseed meal		10.0	10.0		
Dried buttermilk	10.0	10.0	10.0	10.0	10.0
Meat and bone scraps	10.0	10.0		10.0	
Alfalfa leaf meal	2.5	2.5	2.5	12.5	12.5
Fine oyster shell	2.5	2.5	2.5	2.5	2.5
Total weight of mash	100.0	100.0	100.0	100.0	100.0
Scratch					
Wheat	50.0	50.0	50.0	50.0	50.0
Cracked yellow corn	25.0	25.0	25.0	25.0	25.0
Kafir	25.0	25.0	25.0	25.0	25.0
Total weight of scratch	100.0	100.0	100.0	100.0	100.0

From the time the pullets were 8 weeks old they were given their feed ad libitum. Both scratch grain and mash were kept in hoppers before pullets at all times.

Results: Average Live Weight of the Chicks in Each Group, Average Feed Consumption, and the Feed Required to Produce a Gain in Weight of One lb.

	Ration 1	Ration 2	Ration 3	Ration 4	Ration 5
Number chicks in group	240	240	240	240	240
Number chicks survived	215	208	203	206	200
Age of chicks (weeks)	8	8	8	8	8
Average live weight (lbs.)	.917	.945	.825	.843	.740
Average feed consumption (lbs.)	2.53	2.53	2.53	2.53	2.53
Lbs. feed required to produce 1 lb. of gain	3.03	3.01	3.40	3.33	3.85

Average of Three Years' Data on the Pullets of Each Group Showing Average Weight, Feed Required to Produce One Pound of Gain and Annual Egg Production

	Pen 1	Pen 2	Pen 3	Pen 4	Pen 5
Age (weeks)	24	24	24	24	24
Number pullets	121	108	109	87	66
Average live weight (lbs.)	2.99	3.07	3.00	2.86	2.61
Total feed to date (lbs.)	19.11	19.14	18.75	18.70	18.68
Feed required for a pound of gain	6.39	6.23	6.25	6.54	7.16
Average age when first egg was laid (days)	202	203	214	219	226
Annual egg production	153.2	148.3	141.0	157.3	145.8

Reference: New Mexico Agricultural Experiment Station Bulletin 221, "A Comparison of the Nutritive Values of Cottonseed Meal, Alfalfa Leaf Meal, and Meat and Bone Scraps in a Ration for Growing Chicks", pages 4, 5, 7, 8, 12, 13, 14 and 15, tables 3, 7, 8, and 9, March 1934, State College, New Mexico.

The Effect of Varying Amounts of Meat Scrap and Dried Milk for Starting Chicks

Conducted by: Indiana Agricultural Experiment Station.

Conducted at: LaFayette, Indiana.

Period: Eight to ten weeks.

Purpose: To determine the proper amounts of meat and bone scrap and dried milk to feed chicks.

Procedure and Conditions: Six trials, each involving two lots of chicks were conducted for a period of eight or ten weeks. Single Comb White Leghorn chicks were used in Experiment 1, while Barred Plymouth Rocks were used in the other trials. In each experiment the chicks were divided into similar lots according to weight and were placed in the pen when 24 to 48 hours old.

The chicks were brooded in confinement in the Nutritional Laboratories, either on brooder tables or in battery brooders. Both the brooder tables and battery brooders were equipped with wire floors. Heat was provided by small electric hovers on the brooder tables, one hover furnishing heat for the four pens on the table, and by electric heating units in the battery brooders. There was also supplemental heat in the room. The temperature under the hovers was kept at 95° to 100° F. at the start and was reduced gradually. An attempt was made to keep the room temperature at about 70° but it varied considerably, getting as low as 50° on some nights in winter and as high as 100° on some days in summer.

From 20 to 25 chicks were brooded in each pen on the tables. These pens will accommodate this number of chicks until they are eight weeks of age. Approximately 50 chicks were started in a compartment of the heated battery brooders. At four weeks of age each lot of 50 chicks was divided into two lots, one of which remained in the starting battery, while the other was transferred to a compartment of the same size in other batteries which were not heated. At this time heat was discontinued in the starting batteries.

Two 10x12 foot colony brooder houses were used in each of Experiments 4 and 6. These houses were equipped with hard coal brooder stoves and standard feeding and watering equipment. Ground corn cobs were used for litter and the houses were cleaned once each week. In Experiment 4 the chicks were brooded in confinement, while in Experiment 6 they had access to range in small yards after the first two weeks.

In all of the experiments the ingredients of each ration were thoroughly mixed and fed as a dry mash kept before the chicks at all times. Water was given ad libitum.

The feed for each lot was kept in a separate container, numbered to correspond to the lot to which it was to be fed.

The rations fed in the different experiments are given in the following table.

Rations

	Experiments 1 & 2		Experiment 3		Experiment 4		Experiment 5		Experiment 6	
	Lots 1 and 2	Lots 3 and 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Lot 10	Lot 11	Lot 12
Meat and bone scraps*	11.7**	14.6**	12.4*	15.5**	12	15	12	15	12	15
Dried buttermilk	4	6								
Dried skimmilk			4	6	4	6	4	5	4	5
Ground yellow corn	47.3	43.4	47.6	42.5	51	46	49.75	45.75	54	50
Wheat bran	15	15	15	15	15	15	15	15	15	15
Wheat middlings	15	15	15	15	15	15	15	15	15	15
Alfalfa leaf meal	3	3	3	3			3	3		
Steamed bone meal	1 ***									
Salt	1	1	1	1	1	1	1	1		
Cod liver oil stearin	2	2	2	2	2	2				
Concentrated cod liver oil							0.25	0.25		
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Analyses: Meat and bone scraps; Experiments 1 and 2, 51.2% protein; Experiments 3 and 5, 48.5%.

**To supply protein equivalent to 12 per cent (Lots 1, 3 and 5) and to 15 per cent (Lots 2, 4, and 6) of 50% protein meat and bone scraps.

***P2-O5 in 1 per cent steamed bone meal and 11.7 per cent meat and bone scraps (Lots 1 and 3) equal to that supplied by 14.6 per cent meat and bone scraps (Lots 2 and 4).

Average Weights of Males and Females that Lived Through the Experiment and Feed Consumed per Pound Gain

Experiment	Lot	Additions to Basal Ration	Number Chicks			Eight Weeks		Feed Consumed Per Lb. Gain Start to 8 Wks.
			Started	Finished Males	Finished Females	Males	Females	
1	1	11.7 meat & bone scraps 4 dried buttermilk	40	20	18	1.27	1.06	4.12
	2	14.6 meat & bone scraps 6 dried buttermilk	40	17	22	1.35	1.19	3.73
2	3	11.7 meat & bone scraps 4 dried buttermilk	43	27	14	1.10	1.10	3.27
	4	14.6 meat & bone scraps 6 dried buttermilk	43	19	24	1.38	1.23	2.96
3	5	12.4 meat & bone scraps 4 dried skimmilk	100	44	54	1.37	1.26	3.00
	6	15.5 meat & bone scraps 6 dried skimmilk	100	56	42	1.63	1.45	2.88
4	7	12 meat & bone scraps 4 dried skimmilk	213	94	108	1.09	1.00	3.65
	8	15 meat & bone scraps 6 dried skimmilk	213	99	95	1.39	1.22	3.29
5	9	12 meat & bone scraps 4 dried skimmilk	97	44	46	1.31	1.18	2.91
	10	15 meat & bone scraps 5 dried skimmilk	97	47	43	1.40	1.28	2.75
6	11	12 meat & bone scraps 4 dried skimmilk	158	76	69	1.24	1.06	3.15
	12	15 meat & bone scraps 5 dried skimmilk	265	112	113	1.33	1.19	2.93

Reference: Indiana Agricultural Experiment Station Bulletin 421, "Meat Scraps and Dried Milk in Rations for Starting Chicks", pages 3, 4, 7, 8 and 10, tables 1, 2 and 4, April 1937, Lafayette, Indiana.

The Value of Peanuts in Chick Rations

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: Three eight-week trials. The first started April 8, 1935, the second November 23, 1935 and the third March 9, 1936.

Purpose: To determine the value of peanuts in rations for chicks.

Procedure and Conditions: One thousand five hundred Single Comb White Leghorn chicks were used in each of the trials.

The formulas used in this test contained approximately 18 per cent crude protein and were checked for chemical analysis. The calcium and phosphorus content of the ration was also balanced to within a ratio of 1.60-1.65 to 1. One per cent cod liver oil was included in an all-mash ration to insure sufficient vitamin D. The three peanut products in this experiment, ground peanuts with shells, ground peanuts without shells, and peanut meal, were fed in the order named in Lots 3, 4, and 5, as the only protein supplement; in Lots 6, 7 and 8, in combination with dried buttermilk; in Lots 10, 11, and 12, in combination with dried buttermilk and meat scraps. As controls, a combination of dried buttermilk and meat scraps was fed as protein supplements in Lot 1, dried buttermilk in Lot 2, and meat scraps in Lot 9.

Formulas and Composition of Rations Used

Ingredient of Ration	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Lot 10	Lot 11	Lot 12	Lot 13	Lot 14	Lot 15
Pound of ingredients used in formulas															
Yellow corn meal	59	49	34	44	56	42	46	52	60	47	52	58	50	53	57
Wheat shorts	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Alf. leaf meal	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Dried buttermilk	5	25				13	13	13					6	6	6
Meatscrap	10								14	7	7	7	5	5	5
Gr. peanuts with shells			40			20				20			13		
Gr. peanuts without shells				30			15				15			10	
Peanut meal					18			9				9			6
Composition of Rations (per cent)															
Crude protein	17.2	17.7	17.6	17.7	17.7	17.8	17.8	17.8	17.7	17.7	17.7	17.2	17.2	17.2	17.2
Fiber	4.1	3.7	10.2	4.8	5.2	7.0	4.0	4.4	4.2	7.2	4.3	4.7	6.0	4.1	4.4
Fat	5.2	4.0	17.4	17.7	5.7	10.7	10.9	4.9	5.6	11.5	11.7	5.7	8.9	9.1	5.1

Results: Average Weight, Feed Consumption, and Percentage Mortality for Different Lots of Chickens

Lot Number	Average Weight (Lbs.)	Feed Consumed Per Chick (Lbs.)	Av. Percentage Mortality
1	0.989	3.46	5.77
2	0.085	3.50	4.80
3	0.363	2.17	40.0
4	0.335	1.94	36.43
5	0.501	2.35	40.60
6	0.874	3.03	7.26
7	0.865	2.89	8.61
8	1.002	3.61	5.39
9	0.853	3.09	7.35
10	0.697	2.96	8.43
11	0.513	2.36	33.04
12	0.792	2.85	10.98
13	0.915	3.38	3.52
14	0.873	3.42	5.22
15	0.967	2.97	3.98

Reference: Alabama Agricultural Experiment Station Circular 80, "The Value of Peanuts and Peanut Meal in Rations for Chickens" pages, 8, 9 and 10, tables 6 and 7, November 1937, Auburn, Alabama.

Feeding Crossbred Chicks on Rations with Different Percentages of Proteins

Conducted by: Delaware Agricultural Experiment Station.

Conducted at: Newark, Delaware.

Period: November 30, 1937-February 15, 1938.

Purpose: To compare feeds of different protein levels with growing chicks.

Procedure and Conditions: Chicks hatched on November 30, 1937 were placed in brooders the following day, 207 chicks being placed in each of four brooders. The chicks were crossbred obtained by crossing Barred Plymouth Rock males with Rhode Island Red females. They were placed in pens with concrete floors 10x14 feet in an open front, shed roof long brooder house. Each pen had a concrete sunporch 10x12 feet. On the brooding pen floors a sugarcane by-product and peanut hulls were used as litter; on the sunporch shredded corn stover was used. Each brooding pen was equipped with a coal-burning brooder stove with a 56-inch hover.

The all-mash rations were kept before the chicks at all times. Also chick size oyster shell and granite grit were always available. Each pen was equipped with an automatic drinking fountain.

Group weighings were made at intervals of two weeks for the first 10 weeks. At the end of 11, 12, 13 and 14 weeks, the chicks were weighed individually and, when a weight of 2.75 pounds or more was attained they were removed and sold.

Higher protein levels were obtained by increasing the amounts of dried buttermilk and meat scraps, but approximately the same ratio between these two ingredients was maintained in the four rations. In order to keep the mineral content below the point where perosis might occur, steamed bone meal was not included in the two higher protein rations. The percentages of fiber in the rations ranged from 4.2 in the ration of lowest protein content to 3.6 in that of the highest; the percentages of ash from 5.5 in the lowest to 7.6 in the highest.

The following table gives the formulas for the four rations, the average bi-weekly weights of the chicks, and the average pounds of feed consumed by the chicks at different ages.

	Percentages of Protein			
Ingredients	16.3	18.3	20.4	22.3
Percentages of Ingredients in Rations				
Ground yellow corn	43.1	40.1	37.3	34.4
Wheat bran	14.4	13.3	12.4	11.4
Flour wheat middlings	14.4	13.3	12.4	11.4
Ground oat groats	10.7	10.0	9.3	8.6
Meat scraps (55%)	6.5	10.0	13.8	17.2
Dried buttermilk	4.3	6.7	9.2	11.4
Alfalfa leaf meal	4.7	4.7	4.7	4.7
Steamed bone meal	1.0	1.0		
Salt	0.7	0.7	0.7	0.7
Cod Liver Oil Concentrate	0.2	0.2	0.2	0.2
Average Weights of Chicks in Pounds				
Age in weeks				
Initial	0.078	0.077	0.078	0.077
2	0.198	0.221	0.250	0.249
4	0.476	0.546	0.604	0.526
6	0.904	0.995	1.110	1.042
8	1.389	1.538	1.562	1.581
10	1.856	2.063	2.095	2.117
11	2.207	2.397	2.439	2.469
Average Pounds Feed Consumed Per Chick				
2	0.30	0.31	0.32	0.33
4	0.74	0.80	0.83	0.81
6	1.34	1.40	1.47	1.41
8	1.95	2.00	2.03	2.03
10	2.33	2.51	2.46	2.47
11	1.40	1.40	1.40	1.41

Del. Exp. Sta. Bul. No. 210

Results: Feeding Crossbred Chicks on Rations with Different Percentages of Proteins.

	Percentages of Protein			
Factors	16.3	18.3	20.4	22.3
Number of chicks at start	207.0	207.0	207.0	207.0
Percentage mortality	2.4	3.9	3.9	8.2
Number days on feed	77.0	77.0	77.0	77.0
Initial ave. wt. per chick, lbs.	0.078	0.077	0.078	0.077
Final ave. wt. per chicks, lbs.	2.207	2.397	2.439	2.469
Ave. gain per chick, lbs.	2.129	2.320	2.361	2.392
Ave. lbs. feed consumed per chick	8.06	8.42	8.51	8.36
Lbs. feed required per lb. gain	3.78	3.63	3.60	3.69
Cost of ration in dollars per 100 lbs.	2.10	2.23	2.36	2.49

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Reference: Agricultural Education Vol. 15, No. 4, pages 51, 52 and 53, tables 2 and 3, December 1938. Clemson, South Carolina.

VITAMINS

Their use or function, and feeds that supply them.

Vitamin A is essential to the normal growth of chicks. Its absence brings on uneven, stunted growth, and causes adult fowls to have swollen eyes, as in roup. This vitamin is found in green feeds, yellow corn, milk, egg yolk, and cod-liver oil. Plans must be made to include such materials in the ration. Vitamin A supplied in sufficient quantities gives a healthier chick and less susceptible to disease.

Vitamin B is believed to be largely destroyed by heat so that materials containing it are more likely to function when raw than when cooked or heated. It is found in green leaves of plants, milk and its products, whole cereal grains and other seeds, unpolished rice, pasture crops, eggs and yeast. Its absence hampers growth, creates poly-neuritis, prevents normal development of internal organs or secretion, and usually results in the loss of appetite. A ration composed of the usual feeding stuffs will supply adequate vitamin B.

Vitamin C is the anti-scorbutic vitamin and is not considered of great importance in feeding poultry.

Vitamin D is very essential in poultry feeding. Lack of it prevents chicks from forming bones properly so that leg weakness and rickets occur. The deposit of lime and phosphorus in the form of bone fails to take place. This vitamin is furnished in poultry feeding largely through cod-liver oil. Ultraviolet rays, as sunlight not strained through glass, produces the effect of vitamin D. The exposure of birds to direct sunlight is the most practical means of supplying this vitamin.

Vitamin E is present in some animal feeds. It is abundant in green alfalfa, cooked lean meat, and rice. Its presence in rations is necessary for reproduction in animals.

Vitamin G was formerly considered a member of the B group but is believed to be heat-stable and is not destroyed by ordinary cooking. Its absence causes loss of weight, retardation of growth, reduced hatchability and nutritional paralysis. The sources of vitamin G are green leaves of plants, milk and its products, whole cereal grains and other seeds, unpolished rice, pasture crops, eggs and yeast.

Suggestive Questions

Are vitamins essential in a broiler's ration?

How should the vitamins be supplied?

From an economical standpoint can a person afford to leave some of the vitamins out of the broiler's ration?

How does the young chick use the vitamins?

Vitamin A Requirements of Growing Chicks

Conducted by: New Hampshire Agricultural Experiment Station.

Conducted at: New Brunswick, New Hampshire.

Period: 1933-34.

Purpose: (1) To determine the efficiency of various levels of cod liver oil in the supply of an adequate amount of Vitamin A to growing chicks. (2) To study the effect on growth of previously stored up vitamin A, if any, when the ration was later changed to a deficiency basis. (3) To determine the relative amount of vitamin A in sardine oil and its ability to prevent the occurrence of opthalmia.

Procedure and Conditions: This experiment involved the use of eleven groups of 50 New Hampshire Red chicks, or a total of 550 chicks. The test groups were fed in growing batteries as follows:

1. Basal ration—deficient in vitamin A
   140 pounds wheat bran
   140 pounds ground oats
   45 pounds meat scraps (50% protein)
2. Basal plus 1% cod liver oil
3. Basal plus 2% cod liver oil
4. Basal plus 3% cod liver oil
5. 4-12 weeks control
   (25 chicks from Group 9 were removed at end of four-week period and fed only basal ration from then till end of period)
6. 8-12 week control
   (25 chicks from Group 9 were removed at end of eight-week period and fed only basal ration from then till end of period)
7. Basal ration for first two weeks and then basal ration plus 1% cod liver oil.
8. Basal ration plus ½% sardine oil
9. New England College Conference ration (check group)

All chicks were wingbanded and weighed individually by weekly periods with sex notation being made as soon as possible for subsequent weight and growth analysis. Feed consumption was recorded weekly. All mortality was tabulated and autopsy records preserved for analysis.

Groups 1 to 8 inclusive were treated daily with ultra-violet light for a period of 15 minutes at 30 inches distant. This provision was made to furnish a supply of vitamin D to all groups above their normal requirements.

Group 8 was used to determine the relative amount of vitamin A in sardine oil and its ability to prevent the occurrence of opthalmia.

Group 1 showed materially slower growth and presence of a vitamin A deficiency was noted in all chicks but one. Swelling of the eye and some indications of watery eyes were present at four weeks of age. A few chicks which died between nine and ten weeks of age exhibited heavy urate deposits over kidneys which were themselves grayish in color. Nodules in throat and esophagus were found in two chicks upon autopsy.

Groups 2, 3 and 4 showed very little difference in weight gains indicating that the 1% cod liver oil supplied sufficient vitamin A both for prevention of opthalmia and optimum growth. Additional amounts were not used more efficiently when comparing growth and freedom from vitamin A deficiency.

Group 9 (check) receiving the New England College Conference ration weighed at the end of the twelve-week period 2.897 pounds per chick average. This was approximately one-half pound heavier average per chick than the 1, 2 or 3% cod liver oil groups on basal ration.

The 4-12 week control group, No. 5, showed continued normal gains up to the eighth week. After this time the growth rate was reduced and the final weight at twelve weeks showed a loss over the weight at eleven weeks of age.

This indicates that there was apparently enough storage of vitamin A for about four weeks of normal growth. After this period the demand for vitamin A was in excess of the body supply.

Group 6, known as 8-12 week control group, after being removed from Group 9 at eight weeks of age, showed continued gains. The rate of growth however, was somewhat less than that of Group 9. The demand for vitamin A after the eight-week period seems to be in excess of the amount stored up and may be the result of the reduced body gains.

Group 7 which received no vitamin A supply during the first two weeks of life, but received 1% oil in the basal ration from 3 to 12 weeks of age showed better weight gains than did Group 2. Group 2 received 1% cod liver oil plus basal ration for entire period. There was, however, between the ages of two and seven weeks a slackening of weight gains as compared to Group 2. It should be stated that the sex ratio of males to females in Group 2 was 1:1.9 and that in Group 7 was 1:1.

Apparently the reserve supply of vitamin A in the baby chick upon hatching was materially reduced during the first two weeks of life. Following this period five weeks were used to secure from the 1% cod liver oil ration enough vitamin A to replenish the reserve supply and to continue growth with more normal gains. By the actions of this group there is indicated a method of determining vitamin A transfer from the breeder to the baby chick based on livability and growth.

Group 8, fed the basal ration plus ½% sardine oil, showed slightly less weight gains than did the cod liver oil groups. The final average weight per chick at the end of the twelve-week period was 2.097 pounds as compared with the 1% cod liver oil fed group of 2.397 pounds. At no time during the course of the experiment were there any symptoms of a vitamin A deficiency.

In the analysis of the table giving the feed consumption per chick per week there is indicated a direct relationship between Groups 2, 3 and 4 in both total consumption and in feed consumption per pound of gain. The group receiving 3% cod liver oil plus the basal ration was more efficient in feed consumption as evidenced by gain in weight than were the lower cod liver oil fed groups. The order of efficiency is approximately the same as that evidenced in previous years' tests. The check group receiving the New England College Conference ration was the most efficient with but 3.6 pounds of feed per pound gain up to twelve weeks of age.

Average Weight in Pounds Per Chick of the Various Groups by Weekly Periods

	Group								
Week	1	2	3	4	5	6	7	8	9
Initial	.0876	.0872	.0890	.0880			.0888	.0878	.0891
1	.1029	.1142	.1114	.1108			.1169	.1169	.1268
2	.1710	.1843	.1851	.1765			.1837	.1891	.2094
3	.2435	.2811	.2556	.2583			.2245	.2443	.3238
4	.3419	.3981	.3583	.3571	.4860		.3363	.3214	.4632
5	.4678	.5969	.5265	.5079	.6150		.5154	.4750	.6872
6	.5582	.8033	.6921	.6786	.8280		.7300	.6687	.9185
7	.6595	.9616	.9041	.9380	1.045		.9568	.8500	1.194
8	.7866	1.286	1.163	1.202	1.337	1.448	1.277	1.118	1.498
9	.9597	1.521	1.407	1.489	1.585	1.720	1.591	1.378	1.867
10	1.066	1.786	1.725	1.738	1.730	2.043	1.926	1.611	2.231
11	1.205	2.083	1.984	2.117	1.878	2.303	2.283	1.875	2.605
12	1.217	2.397	2.322	2.398	1.864	2.552	2.588	2.097	2.897

Feed Consumption Per Chick Per Week for All Groups

Week	Group 1	2	3	4	5	6	7	8	9
1	.085	.078	.082	.115			.093	.095	.095
2	.186	.207	.217	.168			.191	.228	.207
3	.261	.346	.292	.287			.352	.269	.308
4	.378	.420	.348	.370			.352	.248	.405
5	.646	.642	.554	.500	.600		.579	.548	.643
6	.621	.827	.719	.697	.860		.863	.712	.738
7	.865	.982	.640	.965	1.220		1.022	.900	1.014
8	.712	1.130	1.323	1.048	1.360		1.238	1.012	1.132
9	.875	1.357	1.365	1.211	1.367	1.364	1.693	1.080	1.232
10	.972	1.333	1.350	1.413	1.625	1.500	1.488	1.342	1.433
11	.950	1.850	1.516	1.637	1.166	1.282	1.670	1.555	1.559
12	.866	1.711	1.650	1.258	1.208	1.304	1.556	1.430	1.672
Total	7.417	10.883	10.056	9.669	9.406	5.450	11.097	9.519	10.438
Feed per lb. gain	6.09	4.54	4.33	4.032	6.82	4.93	4.28	4.53	3.63
Ratio of males to females	1:1.3	1:1.9	1:.87	1:1.9	1:2.43	1:1.55	1:1	1:1.4	1:6.1

Mortality

	Number	Per cent	Major cause
Group 1	20	40.0	Vitamin deficiency
Group 2	8	16.0	Pneumonia
Group 3	8	16.0	Pneumonia
Group 4	13	26.0	Pneumonia
Group 5	1	4.0	Pneumonia
Group 6	1	4.0	Pneumonia
Group 7	10	20.0	Pneumonia
Group 8	10	20.0	Pneumonia
Group 9	5	10.0	Pneumonia
Average for all lots		17.3	

Reference: New Jersey Agricultural Experiment Station Bulletin 310, "Vitamin 'A' Requirements of Growing Chicks", pages 2, 13, 14 and 15, tables 6, 7, and 8, November 1938, New Brunswick, New Jersey.

The Vitamin D Requirements of Growing Chicks

Conducted by: Pennsylvania Agricultural Experiment Station.

Conducted at: State College, Pennsylvania.

Period: 1932-1933.

Purpose: To determine the vitamin D requirements of growing chicks.

Procedure and Conditions: Ten groups each consisting of 200 Single Comb White Leghorn chicks of the Pennsylvania State College strain were hatched and placed on experiment April 12, 1932. Each chick was individually weighed and wing-banded at hatching time. These chicks were subjected to the following experimental conditions.

Group Number	Environmental conditions 0 to 12 weeks	Per cent cod liver oil concentrate in total ration	U. S. P. Units Vitamin D per 100 Grams Feed
1	Battery brooder—confined	None	0
2	Battery brooder—confined	1/32	10
3	Battery brooder—confined	1/16	19
4	Battery brooder—confined	1/8	39
5	Battery brooder—confined	3/16	58
6	Battery brooder—confined	1/4	78
7	Battery brooder—confined	3/8	116
8	Battery brooder—confined	1/2	155
9	Colony brooder house—limited range	None	0
10	Colony brooder house—limited range	1.8	39

Groups 1 to 8 were brooded in batteries, each deck of which heated indirectly by hot water so that all decks could be maintained at a uniform temperature. The brooders were located in a well ventilated room equipped with auxiliary heat. No direct rays of the sun were allowed to enter the room.

Groups 9 and 10 were brooded in colony brooder houses of similar size and construction, and heated with hard coal-burning brooder stoves. Limited range was provided for these two groups throughout the entire year in order that the chicks might be exposed to direct sunlight. All groups (1 to 10 inclusive) were fed the following all-mash rations:

	Starting Mash* Pounds	Growing and Laying Mash† Pounds
Ground yellow corn	43.5	45.5
Wheat bran	10.0	10.0
Standard wheat middlings	10.0	10.0
Alfalfa meal	5.0	5.0
Meat scraps (55% protein)	10.0	7.5
Dried skim milk	10.0	7.5
Ground heavy oats	10.0	10.0
Ground limestone (98% CaCO-3)	1.0	4.0
Salt	0.5	0.5
Total	100.0	100.0
Per cent protein	18.4	16.40
Per cent calcium	1.47	2.79
Per cent phosphorus	0.92	0.80

*Fed from one-day old to 12 weeks, †Fed from 12 to 76 weeks of age.

When four weeks old, cockerels from all groups were removed. At 12 weeks of age, 65 representative pullets from each of the 10 groups were transferred to the laying pens. Body weight, health, condition, physical development, and state of maturity were considered in making the selection. At this time the growing and laying mash was substituted for the starting mash. The 19 groups of pullets were housed in a long continuous type of laying house. Direct sunlight was excluded from the pens in which the confined pullets were housed. All pens were of similar construction except the fronts of the two pens in which the range-reared pullets were housed. The fronts of these two pens were arranged to allow direct sunlight to enter. The pullets of the range-reared groups had access at all times to approximately one-fourth acre of alfalfa range.

Results: Vitamin D Requirements for Growing Chicks

Group Number	1	2	3	4	5	6	7	8	9	10
U.S.P. units vitamin D per 100 grams feed	0	10	19	39	58	78	116	155	0 Range	39 Range
Weeks	Average body weight of pullets in pounds									
8	0.66	0.98	1.19	1.23	1.19	1.22	1.16	1.18	1.18	1.24
16	1.34	1.92	2.49	2.50	2.59	2.33	2.46	2.33	2.61	2.61
24	*	2.57	3.35	3.40	3.37	3.38	3.42	3.32	3.54	3.62
	Pounds of feed consumed per pullet to date									
0 to 8	2.58	3.08	3.63	3.60	3.55	3.61	3.49	3.56	3.76	3.97
0 to 16	6.26	7.95	10.10	10.35	10.38	10.18	9.90	10.03	10.95	11.30
0 to 24	*	15.01	19.46	19.67	19.65	19.64	10.28	20.03	19.97	21.48
	Intake of U. S. P. units of vitamin D from ration per pullet to date									
0 to 8	0	136	320	649	936	1,267	1,841	2,497	0	697
0 to 16	0	351	889	1,819	2,739	3,576	5,223	7,089	0	1,984
0 to 24	*	661	1,712	3,457	5,183	6,902	10,171	14,119	0	3,774

*Group 1 was discontinued at 16 weeks.

Reference: Pennsylvania Agricultural Experiment Station Bulletin 334, "Vitamin D for Chicks and Hens", pages 2, 4, and 9, table 1, August 1936, State College, Pennsylvania.

Vitamin D for Chicks

Conducted by: Pennsylvania Agricultural Experiment Station.

Conducted at: State College, Pennsylvania.

Period: 1934-1935.

Purpose: To determine the amount of Vitamin D required for growing chicks.

Procedure and Conditions: For the 1934-35 experiment, 1,575 Single Comb White Leghorn chicks of the Pennsylvania State College strain, hatched November 22, 1933 were used. Nine groups each containing 175 selected chicks were weighed, wing banded and placed in individual brooding pens. The chicks were confined in 12 by 20 foot pens in a long continuous type of brooder house. The pens were similarly constructed and equipped. In order to exclude direct sunlight the windows of each pen were covered with a soap compound.

Each group of chicks was fed the same basal all-mash rations as were used in the 1932-33 experiment. To the ration of each group were added the following amounts of cod liver oil concentrate.

Group Number	Per cent cod liver oil concentrate in total ration	U. S. P. units vitamin D per 100 grams feed
1	0	0
2	1/16	19
3	1/8	39
4	3/16	58
5	1/4	78
6	5/16	97
7	3/8	116
8	1/2	155
9	1	310

All cockerels were removed at an early age. On acount of the severe rachitic condition of the pullets in Group 1 (no vitamin D) this group was discontinued at the end of the eighth week. Between the 12th and 13th weeks of the experiment the starting mash was replaced with the growing and laying mash. At 16 weeks of age, 55 representative pullets from each of the remaining eight groups were selected for the laying pens. Body weight, health, condition, physical development and state of maturity were considered in the selection. The pullets were housed in the same laying house and kept under the same environmental conditions as were the confined pullets of the 1932-33 experiment. Precautions were taken to prohibit any ultra-violet light from entering the pens in which the pullets were confined.

Results: Vitamin D for Chicks

Group Number	1	2	3	4	5	6	7	8	9
U.S.P. units vitamin D per 100 grams feed	0	19	39	58	78	97	116	155	310
Weeks	Average body weight of pullets in pounds								
8	0.65	1.14	1.22	1.23	1.19	1.25	1.25	1.26	1.26
16	*	2.62	2.76	2.76	2.63	2.65	2.73	2.69	2.65
24	......	3.40	3.53	3.59	3.42	3.53	3.65	3.60	3.65
	Pounds of feed consumed per pullet to date								
0 to 8	2.74	3.90	3.91	4.02	3.84	3.92	3.88	4.20	3.95
0 to 16	*	11.94	12.67	12.88	12.27	12.49	12.58	13.00	12.74
0 to 24	..	24.20	25.58	26.04	24.73	25.86	25.74	26.42	25.75
	Intake of U.S.P. units of vitamin D from ration per pullet to date								
0 to 8	0	342	687	1,057	1,347	1,720	2,041	2,954	5,550
0 to 16	*	1,048	2,227	3,390	4,307	5,487	6,620	9,136	17,898
0 to 24	......	2,125	4,495	6,860	8,686	11,363	13,556	18,570	36,189

*Group 1 was discontinued at 8 weeks.

Reference: Pennsylvania Agricultural Experiment Station Bulletin 334, "Vitamin D for Chicks and Hens", pages 11, 12 and 13, table 2, August 1936, State College, Pennsylvania.

Vitamin D Requirements of Growing Chicks as Affected by The Calcium Content of the Ration

Conducted by: Texas Agricultural Experiment Station.

Conducted at: College Station, Texas.

Period: 12 weeks.

Purpose: To determine the vitamin D requirements of growing chicks.

Procedure and Conditions: White Leghorn chicks from the Poultry Division of the Texas Station were used. The hens from which those chicks were hatched were running on free range in sunlight and adequate green food was available at all times. The chicks were hatched in a forced draft incubator and kept in a battery brooder room from which all outside sunlight was excluded, and were allowed a 14-hour feeding period each day. Feed was weighed to the chicks daily and fresh tap water was available at all times.

Two series of rations were fed to duplicate groups of chicks in two experiments. The basal ration used in the first experiment was:

Meat and bone scraps	6 per cent
Cottonseed meal	6 per cent
Dried buttermilk	6 per cent
Dehydrated alfalfa leaf meal	3 per cent
Wheat gray shorts	20 per cent
Salt	1 per cent
Ground yellow corn	58 per cent

In the second experiment the following basal ration was used:

Meat and bone scraps	6 per cent
Cottonseed meal	6 per cent
Dried buttermilk	6 per cent
Dehydrated alfalfa leaf meal	3 per cent
Wheat gray shorts	30 per cent
Salt	1 per cent
Ground yellow corn	48 per cent

In the first experiment using the first ration, 1.1, 1.9, and 2.6 International units of Vitamin D were fed with 1.31 per cent calcium and 1.1, and 1.9 International units of Vitamin D were fed with 1.50 per cent calcium.

In the second experiment using the second ration 1.2, 2.4 and 3.6 Internationl units of Vitamin D were fed with 1.51 and 1.71 per cent calcium.

The vitamin D was supplied by a cod liver oil which contained 26.7 International unit of vitamin D per gram. In varying the calcium content of the rations, oyster shell replaced an equal amount of ground yellow corn. The percentages of oyster shell used with the first ration were 1 and 1.5 per cent and with the second ration were 1.5 and 2 per cent. The phosphorus content of the first and second rations was 0.76 and 0.81 per cent respectively.

Results: Relation of Vitamin D and Calcium to Gain in Weight, Rickets, and Other Criteria on Chickens Fed Ration 1, Experiment 1

Per cent calcium in Ration	1.31			1.50	
International units of vitamin D per 100 grams ration	1.1	1.9	2.6	1.1	1.9
Mean gain of cockerels	1.441	1.724	1.860	1.620	1.900
Mean gain of pullets	1.128	1.295	1.591	1.397	1.563
Lbs. of feed required to produce one lb. of gain	4.61	4.17	3.98	4.44	3.95
Mean percent of bone ash	40.16	43.54	45.00	42.01	44.31
Per cent of chicks that had crooked breast	58.3	27.1	4.2	14.9	2.0
Per cent of chicks that had rickets	68.8	25.0	4.2	25.5	2.0
Number chicks that died during experiment	3	4	4	5	2

Relation of Vitamin D and Calcium to Gain in Weights, Rickets, and Other Criteria on Chickens Fed Ration 2, Experiment 2

Per cent calcium in Ration	1.51			1.71		
International units of vitamin D per 100 grams ration	1.2	2.4	3.6	1.2	2.4	3.6
Mean gain of cockerels	1.571	1.802	1.978	1.577	1.735	2.000
Mean gain of pullets	1.415	1.343	1.672	1.319	1.613	1.599
Lbs. of feed required to produce one lb. of gain	4.10	3.95	3.67	4.19	3.84	3.82
Mean percentage of bone ash	41.55	43.95	47.05	42.63	45.61	46.50
Percent of chicks that had crooked breast bones	37.5	7.0	0.0	20.8	0.0	0.0
Per cent of chicks that had rickets	37.5	14.0	0.0	10.4	0.0	0.0
Number of chicks that died during experiment	7	7	8	16	13	7

Reference: Poultry Science Vol. XVI, No. 2, "Vitamin D Requirements of Growing Chicks As Affected by the Calcium Content of the Ration", pages 106, 107, tables 1 and 2, March 1937.

The Effect of Different Sources and Amounts of Vitamin G Feeds on Growth of Chicks

Conducted by: Cornell University Agricultural Experiment Station.

Conducted at: Ithaca, New York.

Period: Eight weeks.

Purpose: To determine the effect of different sources and amounts of vitamin G feeds on the growth of chicks.

Procedure and Conditions: In the work with chicks, a basal diet, composed largely of ground yellow corn, wheat-flour middlings, and purified casein, was fed. The protein content of this diet was standardized at 25 per cent protein, moisture-free basis. The proportions of the various ingredients used in a typical basal diet were as follows:

Chick Basal Diet

	Per cent
Ground yellow corn	60.0
Wheat-flour middlings	20.0
Purified casein	15.5
Steamed bone meal	2.0
Pulverized limestone	1.0
Salt, iodized	0.5
Cod-liver oil	1.0

The vitamin G carriers were incorporated in the basal diet in such a way as to keep the protein content at 25 per cent. This was accomplished by making such adjustments in the quantity of ground corn and of casein in these diets as would compensate for the protein content of the sources of vitamin G.

White Leghorn chicks of the Cornell strain were used in the experimental work. In general, 25 chicks were put in each lot. The chicks were weighed individually at weekly intervals throughout the experiment. All the growth data were weighed for sex influence by averaging the average weights for each sex.

Effect of Feeding Graded Quantities of Vitamin G on Growth of Chicks

A. Yeast autoclaved for six hours at 121°C., 25 chicks in each lot

Diet	Average weight of chicks at 8 weeks (lbs.)
No yeast	.359
2.5 per cent yeast	.820
5 per cent yeast	1.187
10 per cent yeast	1.350

B. Liver extract, protein-free, 25 chicks in each lot

Diet	Average weight of chicks at 8 weeks (lbs.)
No liver extract	.399
0.23 per cent liver extract	.846
0.47 per cent liver extract	1.185
0.70 per cent liver extract	1.396

C. Dried skimmilk, 25 chicks in each lot

Diet	Average weight of chicks at 8 weeks (lbs.)
No dried skimmilk	.554
2 per cent dried skimmilk	.794
4 per cent dried skimmilk	1.051
6 per cent dried skimmilk	1.270
8 per cent dried skimmilk	1.219
10 per cent dried skimmilk	1.115
12 per cent dried skimmilk	1.340
14 per cent dried skimmilk	1.292

D. Dried whey, 25 chicks in each lot

Diet	Average weight of chicks at 8 weeks (lbs.)
No dried whey	.359
0.63 per cent dried whey	.444
1.25 per cent dried whey	.575
2.5 per cent dried whey	.618
5 per cent dried whey	1.228
10 per cent dried whey	1.294

It is evident also that the growth response obtained by feeding graded quantities of vitamin G decreases rapidly at the higher levels, and finally approaches zero, in accordance with the "law of diminshing increment" (Spillman, 1924). This is an illustration of the commonly observed phenomenon, that inherited growth regulators come into play and prevent the ingestion of an excess quantity of an essential nutritive factor from having any stimulative effect on the rate of growth which is normal for the species.

Reference: Cornell University Agricultural Experiment Station Bulletin 660, "The Vitamin G Requirement of Poultry", pages 3, 4, 6 and 7, table 5, September 1936, Ithaca, New York.

Mineral Supplements

Are minerals necessary in a broiler's ration?

What are minerals?

Minerals are sometimes referred to as ash including those mineral compounds which are a part of bones and tissues, eggs, shells, and feedstuffs. Essential for normal, strong tissues and bony framework. Calcium is probably the most important mineral required or its forms, and in combination with phosphorus and magnesium, an important part of the bone. Other minerals probably required in poultry rations are potassium, silicon, sulphur, chlorine, sodium, iodine, iron and manganese.

How are minerals used by the broiler?

Minerals are used for body maintenance. As has already been stated the broiler's body is made up of approximately 4% minerals. Minerals are essential for proper bone development.

Minerals also appear to assist in the more complete digestion of proteins and other nutrients. It has been found that mineral contents of grain feeds is not enough to meet the needs of the laying hen. Therefore, the required amount of mineral must be supplied from other sources.

Meat protein sources contain considerably more minerals than the grain sources of protein. This fact should be considered in feeding the broiler.

Sodium, chlorine, phosphorus, and calcium are the minerals most commonly deficient in the broiler's ration. The sodium and chlorine may be supplied very easily by the addition of the small amount of salt in the ration. Calcium may be supplied by using oyster shell or limestone. This mineral is one of the most important and should be supplied in sufficient quantities at all times.

Suggestive Questions

1. Why are minerals needed in a broiler ration?
2. What minerals are needed by broilers?
3. How may minerals be supplied?
4. What would be the results if minerals were not supplied in a broiler ration?

Limestone Grit Desirable

A ration of corn, middlings, milk, and salt will produce good results if chicks are allowed to run out into the sunshine in the late spring and summer. Such a ration is too low in calcium if the chicks are brooded inside. Several trials have shown that late April or early May chicks can be raised from baby chicks to maturity on the simple ration above if they can run out into the sunshine as in a sand-gravel yard. That inside chick requires more mineral is shown in the table given below.

Effect of Adding Minerals to Simple Ration

	Windows Closed Quartz Lamp		Sunshine Open Windows		Windows Closed		Windows Closed Cod liver oil	
	No Mineral Lot 3	Mineral Addition Lot 4	No Mineral Lot 5	Mineral Addition Lot 6	No Mineral Lot 7	Mineral Addition Lot 8	No Mineral Lot 9	Mineral Addition Lot 10
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Wt. at start	.075	.085	.085	.085	.085	.085	.087	.087
2nd wk.	.204	.209	.197	.206	.164	.202	.195	.195
6th wk.	.554	.634	.583	.618	.234	.596	.590	.577
8th wk.	.823	.985	.853	.915	Died	.832	.813	.878
Per cent died	18	2	6	0	100	2	2	2
Av. % ash	40.88	41.85	39.06	42.37	24.81	36.95	24.81	42.48
Blood calcium	11.19	12.57	11.88	11.69	8.54	10.75	9,65	11.78
Blood phosphorus	6.00	5.23	6.99	6.37	3.70	4.48	6.71	7.00

Basal Ration made of: Yellow corn, 65; Wheat middlings, 16; Dried milk, 18; Salt 1.

No mineral groups—Basal	100
Mineral groups—Basal	95
Limestone	2
Steamed bone	3
	100

Single Comb White Leghorns confined inside; shaving litter.

Reference: Wisconsin Agricultural Experiment Station Bulletin 434, "Chick Feeding", page 9, table 3, February 1936, Madison, Wisconsin.

Salt Additions Desirable

Good chicks have been grown at the Station with rations that did not contain any common salt (sodium chloride) addition. Rations that carried as much as 5% of common salt appear to be mildly injurious. It is true that generous supplies of chlorine are needed to make hydrochloric acid in the stomach which aids in protein digestion. The results seem to show quite definitely that it is well to add from one-half to one pound of salt to each hundred pounds of chick mash.

Is Salt a Desirable Addition to a Chick Ration?

Rations		Average weight of chicks in pounds			
		Start	4 wks.	8 wks.	12 wks.
Lot 5B					
Basal	100				
Salt	0	.083	.365	.900	1.67
Lot 6B					
Basal	99				
Salt	1	.092	.405	1.06	1.82
Lot 7B					
Basal	95				
Salt	5	.090	.361	.885	1.63

Single Comb White Leghorns, sand yards, shavings litter, sunshine.

Basal ration consisted of ground yellow corn, 45; wheat bran, 15; standard middlings, 15; dried milk, 12; meat scrap, 6; alfalfa leaf meal, 3; limestone grit, 3.

The results of this trial indicated that 5% of salt was more than was desirable.

Reference: Wisconsin Agricultural Experiment Station Bulletin 434, "Chick Feeding", page 10, table 4, February 1936, Madison, Wisconsin.

Home Mixed and Simplified Rations

In producing broilers it is necessary to reduce the feed cost to a minimum.

Suggestive Questions

1. Are home mixed rations cheaper than factory mixed?
2. Will home mixed rations produce broilers as efficient as factory mixed rations?
3. How will a simplified ration effect the cost?
4. Which ration is best, a simple or complex ration?

Home Mixed Rations for Chicks

Conducted by: Future Farmer Chapter of the Seneca High School.

Conducted at: Seneca, South Carolina.

Period: 1937-1938.

Procedure and Conditions: For the past few years the members of the Future Farmer Chapter of the Seneca High School, Seneca, South Carolina, have formulated and mixed rations for feeding baby chicks and pullets. They bought from local feed dealers the ingredients they could not furnish from home, weighed out the necessary amounts, and mixed their feeds with shovels on a boarded platform in the basement of the school building.

The following chicks rations was formulated at the Conference of the New England Colleges in October 1936.

Chick Mash

200	pounds yellow corn meal
100	pounds wheat bran
100	pounds wheat flour middlings
50	pounds meat scraps not less than 50 per cent protein
100	pounds ground oats (38-40 lbs. to the bushel of oat groats)
50	pounds dried skimmilk or dried buttermilk
25	pounds fish meal not less than 50 per cent protein
25	pounds alfalfa not more than 20 per cent fiber
15	pounds calcium carbonate (ground oyster shell or ground limestone with a content of not less than 96 per cent calcium carbonate)
5	pounds common salt

Add to the above 7 pounds of cod-liver oil, sardine 85 U. S. P. vitamin D units per gram, or the equivalent of cod-liver oil vitamin A and D concentrates; or the vitamin D supplement should be used as directed by manufacturers.

Chick Grain

200	pounds yellow corn
100	pounds wheat

In 1937 this formula was adopted by the Seneca F. F. A. Chapter as a basal ration. A few slight changes were made to effect lower prices without weakening the feeding value of the mash. One hundred pounds yellow corn meal was used instead of ground oats, and 25 pounds of cottonseed meal or peanut meal was substituted for half the dried milk.

The mash was fed for the first six or eight weeks and the grain mixture used only after the chicks were older and in growing out the pullets. The mash was placed before the chicks at all times in small hoppers and sufficient water was always available.

In 1938 the variations made in the New England formula were similar to those made in 1937. A vegetable protein was substituted for half the dried milk and an equal amount of yellow corn meal replaced the ground oats. Concentrated cod-liver oil was used as directed by the manufacturer.

Results: Feeding Home-Mixed Rations to Barred Rock Broilers

Student Number	Number Chicks Bought	Number Chicks Raised	Number Weeks Fed	Total Pounds Feed Fed	Cost of Feed in Dollars	Total Wt. of Broilers Sold in Pounds
1937						
1	295	270	10-12	2200	66.00	585
2	378	345	9-11	2755	82.65	667
3	104	92	9-11	775	23.25	187
4	203	198	8-12	1375	41.25	391
5	308	264	10-18	2100	72.40	572
6	304	266	9-12	2300	74.88	582
7	206	190	9-11	1400	42.00	389
1938						
1	308	302	8-10	2500	63.00	611
2	301	258	8-12	2300	58.50	574
3	355	335	8-11	2650	66.25	662
4	308	280	9-10	2000	50.00	570
5	308	300	9-13	2850	71.25	597
6	203	199	8-9	1500	38.00	383
7	203	192	9-12	1540	38.50	391
8	308	284	9-11	2550	63.65	583
9	254	238	9-12	2328	58.15	385

Reference: Agricultural Education, Volume 15, No. 4, pages 61 and 62, table 11, December 1938, Clemson, South Carolina.

Simplified Rations for Farm Chickens

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn, Alabama.

Period: Two years, 1931 and 1932.

Purpose: To compare simple rations used to feed growing chicks.

Procedure and Conditions: Day-old Single Comb White Leghorn chicks of good breeding were used in this experiment. The flock from which the chicks were produced was tested for pullorum disease and rigidly selected for vigor. Permanent identification of chicks in the various lots was assured by toe marking each chick. Each lot contained 350 chicks in 1931 and 100 chicks in 1932. All chicks were uniformly housed and brooded in confinement. Each lot of chicks was allowed to run on an 8 by 10-foot, wire-floored porch, which permitted exposure to direct sunshine and at the same time minimized the possibilities of contact with disease-producing organisms.

The chicks in all lots were fed all-mash rations which were kept before them continuously in small wooden hoppers. They were watered in fruit jar drinking fountains for the first few days and then in partially covered galvanized troughs. The control group of chicks, Lot 1, was fed one of the standard complex rations which could be depended upon to produce satisfactory results. Lots 2 and 8 were fed simplified rations. The formulas of the rations fed in this experiment were:

Lot 1

	Lbs.
Yellow corn meal	45
Wheat shorts	15
Meat scrap	2
Ground oat groats	20
Dried buttermilk	10
Alfalfa meal	2
Linseed oil meal	2
Bone meal	2
Charcoal	1
Salt	1
Water to drink	

Lot 2

	Lbs.
Yellow corn meal	100
Bone meal	5
Marble grit	5
Salt	1
Skimmilk to drink	

Lot 3

	Lbs.
White corn meal	100
Bone meal	5
Marble grit	5
Salt	1
Skimmilk to drink	

Lot 4

	Lbs.
Yellow corn meal	80
Wheat shorts	20
Bone meal	5
Marble grit	5
Salt	1
Skimmilk to drink	

Lot 5

	Lbs.
White corn meal	80
Wheat shorts	20
Bone meal	5
Marble grit	5
Salt	1
Skimmilk to drink	

Lot 6

	Lbs.
Yellow corn meal	70
Wheat shorts	20
meat Scrap	16
Bone meal	3
Salt	1
Water to drink	

Lot 7

	Lbs.
Yellow corn meal	75
Ground oats	15
Meat scrap	16
Bone meal	3
Salt	1
Water to drink	

Lot 8

	Lbs.
Yellow corn meal	85
Ground oats	15
Bone meal	5
Marble grit	5
Salt	1
Skimmilk to drink	

Five lots, 1, 2, 4, 5, and 8, were carried through the growing and laying periods. The other lots were unsatisfactory and were discontinued at the close of the brooding period. The cockerels were removed from each lot at eight weeks of age, and the pullets placed in Auburn type laying houses where they remained throughout the experiment. Each lot continued to receive the same ration which they had received during the brooding period except that whole corn was given as a scratch grain to the simplified-ration lots. Lots receiving yellow corn meal in the mash were given yellow corn as a scratch grain, and lots which received white corn meal in the mash were given white corn as a scratch grain. Lot 1, the control group, received a scratch grain consisting of equal parts of cracked yellow corn and whole wheat and was changed from the complicated starting mash to a complicated growing mash consisting of: 30 pounds yellow corn meal, 20 pounds ground oat groats, 15 pounds wheat shorts, 10 pounds wheat bran, 5 pounds alfalfa meal, 5 pounds meat scrap, 7 pounds dried buttermilk, 3 pounds bone meal, 3 pounds linseed meal, 1 pound charcoal, and 1 pound fine salt.

Results: Simplified Rations for Farm Chicks

CHICKS

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
Av. weight of chick (Lbs.)								
2 weeks	.190	.160	.165	.190	.180	.165	.135	.170
4 weeks	.340	.275	.265	.325	.290	.260	.205	.295
6 weeks	.625	.525	.490	.635	.585	.540	.450	.560
8 weeks	.825	.655	.590	.770	.715	.645	.560	.705
Av. feed consumption per chick (Lbs.)								
Mash	2.31	1.98	2.02	2.19	2.30	1.99	2.30	2.08
Skimmilk		2.21	2.34	2.23	2.36			2.10
Average mortality	10.0	12.1	18.3	10.4	18.5	29.5	39.9	12.8

PULLETS

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
Av. weight of pullets (Lbs.)								
8 weeks	.825	.655		.770	.715			.705
12 weeks	1.67	1.33		1.57	1.40			1.32
16 weeks	2.21	2.03		2.15	2.08			2.03
20 weeks	2.41	2.36		2.51	2.27			2.33
Av. feed consumption per pullet (Lbs.)								
Mash	8.19	6.09		6.45	6.10			5.74
Grain	2.67	2.32		1.69	1.68			2.75
Skimmilk		15.81		22.87	18.77			15.64

Reference: Alabama Agricultural Experiment Station Circular 66, "Simplified Rations for Farm Chickens", pages 3, 4, 5, 6, 7, and 8, tables 1, 2, 3, 4, 5, June 1934, Auburn, Alabama.

Production Costs with Growing Chicks

Conducted by: Missouri Agricultural Experiment Station.

Conducted at: Columbia, Missouri.

Period: 1931.

Procedure and Conditions: The birds used in this investigation were the strains of Single Comb White Leghorns, Rhode Island Reds, and White Plymouth Rocks which have been bred at this Station for a number of years. The Leghorns and Rocks average slightly below standard weight at maturity, but the Reds are standard weight when mature.

The chicks were hatched at weekly intervals from February 7 to April 11, each hatch being numbered consecutively, thus hatch number 3101 was hatched February 7, hatch number 3105, March 7, etc.

All chicks were placed in battery brooders when removed from the incubator and kept there for four weeks. Each chick was pedigreed, being wing-banded when removed from the pedigree baskets at hatching time. After four weeks in the battery brooders the chicks were placed in 10 by 12 colony houses which were heated with colony brooder stoves.

An all-mash ration was fed for the first eight weeks. This ration was placed before the chicks as soon as they were taken from the incubator and was kept before them continuously. The all-mash mixture used was:

	Pounds
Yellow corn meal	50
Bran	15
Shorts	15
Dried milk	15
Bone meal	4
Cod liver oil	1
Salt	1

When the chicks were 8 weeks old the mash was changed to the following mixture:

	Pounds
Yellow corn meal	100
Bran	100
Shorts	100
Meat scrap	40
Dried milk	20
Bone meal	16
Salt	4

Beginning at eight weeks cracked yellow corn was placed in hoppers and kept before the chicks at all times. These rations were continued until the birds were transferred to the laying house or sold.

The following table shows the feed consumption by four-week intervals to the age of 12 weeks and the total up to the age of 20 weeks. The average feed consumption for the three four-week periods was 84,257 and 397 pounds respectively. Thus to the age of 12 weeks the total feed consumption per 100 chicks was 738 pounds, consisting of 621 pounds of starting and growing mash and 117 pounds of grain. To the age of 20 weeks the total feed consumption per 100 chicks was 1578 pounds. This was made up of 341 pounds of starting mash, 669 of growing mash and 568 pounds of grain.

Feed Consumption Per 100 Chicks—Leghorns and Heavy Breeds

Hatch	Age in Weeks						
Number	0-4	4-8	8-12		8-20		Total
			Mash	Grain	Mash	Grain	
1	93	307	262	129	1187	587	1774
2	88	244	353	121	981	751	1732
3	82	259	288	121	873	698	1571
4	76	206	310	161	957	599	1556
5	86	261	276	133	993	448	1441
6	79	201	315	80	1048	489	1537
7	92	243	295	62	1089	490	1529
8	82	339	173	145	1005	481	1486
9	81	250	251	99			
Average	84	257	280	117	1010	568	1578
To date	84	341	621	117			

Results: Rate of Growth

	Age in Weeks—Weight in Pounds					
	Day Old	4	8	12	16	20
Females						
White Leghorns	.089	.38	.99	1.62	2.17	2.50
Rhode Island Reds	.093	.40	1.06	1.88	2.67	3.36
White Rocks	.092	.37	1.05	1.82	2.54	3.23
Males						
White Leghorns	.091	.414	1.18	1.94	.....	.....
Rhode Island Reds	.093	.40	1.6	2.14	3.36	4.40
White Rocks	.092	.40	1.22	2.18	3.34	4.37

The weights of the pullets at the age of 12 and 20 weeks for the various hatches are shown in the table that follows. There appears a marked tendency for the birds to make less rapid growth as the date of hatch occurs later in the season. The advantage of early hatching as influencing growth is readily apparent as one compares the weight at 12 weeks of hatches No. 1 and 2 with hatches No. 8 and 9. Similar data for the cockerels are also shown in the table. In the case of the White Leghorn males in hatches 1 and 2, these birds at the age of 10 weeks were transferred to feeding batteries where they failed to make expected gains. The White Leghorn males from these hatches which were retained as prospective breeders and allowed to remain on the range averaged 2.25 pounds. In the remaining hatches the cockerels were retained in colony houses until marketed.

At the age of 20 weeks the advantage of early hatching is plainly evident for the general purpose breeds although not so marked for the Leghorns. The advantages of early hatching are to be found in considering the percentage of pullets which were banded and placed in laying quarters. The percentage of pullets retained from hatches 1, 2, 3 hatched February 7 to February 21 was 78 as compared to 61 from hatches 8 and 9 hatched March 28 to April 4. In these data the Rhode Island Reds were eliminated due to a much higher degree of culling because of the failure to meet the color requirements expected of the breed.

Influence of Hatching Date on Growth

Hatch	Date Hatched	Weight in Pounds						Weight of Males at 12 Wks.—Lbs.		
		R. I. Reds		White Rocks		White Leghorns		R. I. Reds	White Rocks	White Leghorns
		12 Wks.	20 Wks.	12 Wks.	20 Wks.	12 Wks.	20 Wks.			
		Pullets						Cockerels		
3101	Feb. 7	2.31	3.73	2.08	3.64	1.86	2.52	2.47	2.40	2.02
3102	Feb. 14	2.06	3.50	1.90	3.10	1.68	2.65	2.34	2.40	1.87
3103	Feb. 21	2.02	3.63	1.92	3.20	1.70	2.43	2.19	2.20	2.11
3104	Feb. 28	2.02	3.40	1.82	3.20	1.66	2.43	2.08	2.35	1.87
3105	Mar. 7	1.88	3.41	1.85	3.44	1.53	2.33	2.18	2.16	2.04
3108	Mar. 28	1.84	3.28	1.81	3.05	1.58	2.61	1.91	2.06	1.87
3109	Apr. 4	1.67	3.10	1.74	2.94	1.44	2.22	1.88	1.92	1.70
Av.		1.88	3.36	1.82	3.23	1.62	2.50	2.14	2.18	1.94

Reference: Missouri Agricultural Experiment Station Bulletin 313, "Some Production Costs With Growing Chicks", pages 3, 4, 5, 6, 7, 8, and 9, tables 3, 4, 9 and 10, July 1932, Columbia, Missouri.

Comparing Supplement Feeding with a Commercial All Mash Chick Starter

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: Seven weeks in 1934.

Purpose: To compare supplement feeding with a commercial all mash chick starter.

Procedure and Conditions: This test consisted of two lots with 248 chicks in each lot.

Lot 1 was fed the supplement mixture and Lot 2 the commercial feed.

The supplement feed consisted of

100 pounds	commercial 32% protein supplement
100 pounds	wheat shorts
200 pounds	corn meal
33 pounds	dried milk

The all mash commercial starting mash was a leading brand found in all the markets in the country.

Results: Average Weight by Weeks in Pounds

	First Week	Second Week	Third Week	Fourth Week	Fifth Week	Sixth Week	Seventh Week
Lot 1	.115	.2	.3	.43	.54	.73	.96
Lot 2	.12	.19	.28	.40	.53	.70	.93

Reference: Unpublished information of Poultry Department, Mississippi Agricultural Experiment Station, State College, Mississippi.

The Effect of Fiber in Rations for Baby Chicks

Conducted by: Oklahoma Agricultural Experiment Station.

Conducted at: Stillwater, Oklahoma.

Purpose: To determine if possible the maximum, minimum and optimum amounts of fiber for baby chicks.

Procedure and Conditions: Six lots of 100 chicks, 55 White Leghorns, 30 Rhode Island Reds and 15 Barred Rocks were used. Each lot was selected as uniformly as possible and placed in a battery brooder. One hundred chicks were put in each compartment which was 32x29 inches in size. The chicks were kept in the battery brooder house. Each lot had a pen 6x12 feet and a concrete sun porch of equal size. All lots were kept in this broder house until they were moved to their laying quarters.

No green feed in any form was fed, other than what was in the ration. One per cent of cod liver oil was mixed with the feed. The chicks were given Ration I for the first eleven weeks when Ration II was substituted and fed until the pullets were removed to the laying house. At maturity all pullets were leg banded and removed to a 20x20 laying house and given the Standard A and M. laying mash. Trapnest records and other information is being secured for a continuation of the study.

Ration No. I

Rations Fed from 1 to 12 Weeks of Age

Ingredient	Lot 1 Parts	Lot 2 Parts	Lot 3 Parts	Lot 4 Parts	Lot 5 Parts	Lot 6 Parts
Wheat bran	0	0	0	0	0	27
Yellow corn meal	53	53	53	53	53	27
Wheat shorts	23	23	23	23	23	27
Meat scraps	6	6	6	6	6	3
Cottonseed meal	6	6	6	6	6	3
Dried milk	6	6	6	6	6	3
Mineral mixture	6	6	6	6	6	3
Oat hulls	0	3	6	10	15	0
Alfalfa meal	0	0	0	0	0	7
Alfalfa stem meal	0	3	6	10	15	0
Protein mixture	0	2	4	7	10	0
% protein	16.42	16.49	16.35	15.81	16.44	16.40
% fiber	3.84	5.15	6.34	8.75	10.29	7.30

Note: Lot 6 was fed the Standard A. & M. Chick ration. The protein mixture was composed of equal parts of cottonseed meal, dried milk and meat scraps.

Ration No. II

Rations Fed from 12 to 21 Weeks of Age

Ingredient	Lot 1 Parts	Lot 2 Parts	Lot 3 Parts	Lot 4 Parts	Lot 5 Parts	Lot 6 Parts
Yellow corn meal	44	44	44	44	44	38
Kafir meal	16	16	16	16	16	25
Ground oats	16	16	16	16	16	0
Wheat shorts	12	12	12	12	12	14
Dried milk	0	0	0	0	0	13
Meat scraps	3	3	3	3	3	1.5
Cottonseed meal	3	3	3	3	3	1.5
Wheat bran	3	3	3	3	3	1.5
Mineral mixture	3	3	3	3	3	1.5
Oat hulls	0	3	6	10	15	0
Alfalfa stem meal	0	3	6	10	15	0
Alfalfa leaf meal	0	0	0	0	0	4
Protein mixture	0	2	4	7	10	0
% protein	13.2	13.29	13.53	13.25	13.87	13.59
% fiber	4.04	5.96	7.62	9.48	11.45	5.57

Total Feed Consumed Per Chick in Pounds for 21 Weeks

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
	16.279	16.316	18.166	15.608	15.642	16.169

Results: Fiber in Rations for Chicks

Average Weight of Chick in Pounds

Date	Age in Weeks	Lot 1		Lot 2		Lot 3		Lot 4		Lot 5		Lot 6	
2-12-30	Day old	.0740		.0727		.0730		.0740		.0749		.0730	
3-13-30	4	.4030		.3876		.4281		.4126		.3720		.3451	
4-10-30	8	1.055		.9760		.9750		.9940		.946		.8490	
5- 8-30	12	1.734		1.755		1.8530		1.8350		1.691		1.587	
		White Leg.	R. I. Red	White Leg.	R. I. Red	White Leg.	R. I. Red	White Leg.	R. I. Red	White Leg.	R. I. Red	White Leg.	R. I. Red
6- 5-30	16	2.089	2.808	2.233	2.692	2.277	2.883	2.238	2.83	2.107	2.69	2.042	2.557
7- 3-30	20	2.416	3.38	2.463	3.230	2.600	3.427	2.528	3.18	2.392	2.13	2.348	3.016
7-17-30	22	2.56	3.46	2.61	3.31	2.61	3.53	2.66	3.33	2.56	3.28	2.41	3.10

Mortality Record—100 chicks per Lot

Period	No. Live	% Mort.	No. Live	% Mort.	No. Live	% Mort.	No. Live	% Mort.	No. Live	% Mort.	No. Live	% Mort.
Weeks												
1st—4th	87	13	94	6	86	14	97	3	100	0	99	1
5th—8th	86	1	89	5	84	2	94	3	99	1	97	2
9th—12th	86	0	89	0	82	0	94	0	97	2	96	1
13th—16th	85	1	89	0	82	0	94	0	95	2	95	1
17th—21st	84	1	88	1	80	2	94	0	0	0	94	1
Total	84	16%	88	12%	80	20%	94	6%	95	5%	94	6%

Reference: 1926-1930 Report of Oklahoma Agricultural Experiment Station, pages 151, 152, 153, 154, and 155, tables 64, 65, 66, 66a, and 67, Stillwater, Okla.

Comparison of Standard Breeds and Cross Breeds in Meat Production

Conducted by: New Jersey Agricultural Experiment Station.

Conducted at: New Brunswick, New Jersey.

Period: 12 weeks—chicks hatched March 4, 1937.

Purpose: The experimental work was set up with the following point in mind: To obtain information on the effect of crossing standard breeds on viability, rate of growth and efficiency of feed consumption.

Procedure and Conditions: Pedigreed hatching eggs were obtained from two pens of B. P. Rocks, two of R. I. Reds, and two of R. I. Red males x B. P. Rock females. The two R. I. Red males which headed the crossbred pens were selected on the basis of having the greatest number of full sisters in the standard R. I. Red pens. The B. P. Rocks used in these experiments came from the station strain, which may be characterized as typically production bred, and the R. I. Reds came from an exhibition strain characterized by low hatchability and poor fecundity. In order to secure as large a number as possible of chicks of the same age, hatching eggs were collected from 30 days previous to incubation. Chicks were hatched on March 4, 1937, as follows: 72 Rhode Island Reds, 238 Barred Plymouth Rocks, and 243 hybrids.

The chicks were brooded under electric hovers, allowed free access to grassy yards during the entire growing period, and the sexes were separated at 10 weeks of age. The following ration was fed:

Mash Ration

20	pounds yellow corn meal
20	pounds wheat bran
20	pounds flour middlings
20	pounds pulverized oats
10	pounds meat scrap
5	pounds dried skimmilk
5	pounds alfalfa leaf meal
2	pounds limestone flour
¼	pound fortified cod-liver oil
½	pound salt

Grain Ration

100	pounds cracked yellow corn
150	pounds wheat

Results: Feed Consumption, Body Weight and Mortality of Standard-Bred and Crossbred Chicks

Age Wks.	Rhode Island Reds			Barred Plymouth Rocks			Red Males x Rock Females		
	Lbs. Feed per 100 Chicks	Weight of Chick	% Mortality	Lbs. Feed per 100 Chicks	Weight of Chick	% Mortality	Lbs. Feed per 100 Chicks	Weight of Chick	% Mortality
2	19	.16		22	.17		31	.17	
4	81	.37	3.5	85	.40	6.5	98	.42	1.6
6	206	.72		211	.79		259	.99	
8	407	1.16	1.4	373	1.04	2.4	471	1.23	1.2
10	710	1.60		661	1.75		717	1.94	
12	950	2.20	1.4	945	2.50	.9	996	2.67	0
Total	950		6.3	945		9.8	996		2.8

Reference: New Jersey Agricultural Experiment Station Bulletin 656, "Meat Production in Chickens", pages 3, 4, 7, and 8, tables 1, 2, 3, December 1938, New Brunswick, New Jersey.

MARKETING

Marketing is one of the most vital factors in a broiler business and in this connection there are certain questions dealing with broiler marketing that should receive consideration.

1. When is the best time to market broilers?

A tabulation of monthly broiler prices for three available markets, New Orleans (Table 1), New York (Table 2), and Chicago (Table 3) for a ten year period, 1930-39, and a graph of average monthly prices (Table 4) is presented for consideration on this question. These tabulations should be helpful in determining the best time to market broilers. The monthly prices should be kept to date. This information may be secured from several of the daily papers. The above mentioned tabulations were secured from the New Orleans Times-Picayune.

2. Where is the best place to market broilers?

The tabulations mentioned above gives monthly prices on three available markets, New Orleans, New York and Chicago, for ten years, 1930-1939. To decide between these markets or other markets the cost of transportation, time required to get to market, reliability of person or concern to whom broilers are shipped and cost of selling should be determined. In presenting the broiler prices of these markets it does not mean that these are the only markets available. There are available markets in Mississippi for a limited number of broilers. All available markets favorably located should be considered before a selection is made.

3. How should broilers be marketed?

There are several ways of marketing broilers. An attempt is made to point out some of the ways.

a. Shipping by express and selling through commission dealers

b. Shipping by freight and selling through commission dealers

c. Pooling broilers and shipping by truck and selling through commission dealers

d. Selling to poultry truckers from New Orleans and other markets

e. Selling to local poultry dealers

f. Selling to local feed dealers (This method is practiced in the Jackson Area)

g. Selling to custom trade (hotels, restaurants, etc.)

The brolier producer should investigate the different ways of marketing to determine the highest net returns before selecting a way to market.

Suggested Form for Figuring Returns Using Different Methods of Marketing

Items of Expense	Ship by express Sell through commission dealers	Ship by freight Sell through commission dealers	Ship by truck Sell through commission dealers	Sell to poultry truckers	Sell to local poultry dealer	Sell to local feed dealer	Sell to custom trade	Other ways	Other ways
Transportation	x*								
Shrinkage	x								
Commission	x								
Total cost of marketing									
Price quoted									
Returns above cost of marketing									

*The checked items of expense are the usual expenses with this method of marketing. This comparison should be made with other methods.

Suggestive Questions

1. What season of the year are broilers the best price?
2. Where is the best place to market?
3. What is the best way of marketing?
4. What risks are involved in marketing broilers?
5. What price would have to be received for broilers to make a profit?

Table 1

New Orleans Market Prices for Broilers

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1930	26.6	26.9	34.5	39.2	36.3	30.6	27.0	22.3	25.3	23.3	21.3	17.6
1931	21.1	30.6	33.0	34.5	31.7	28.0	24.0	22.7	20.2	18.7	18.4	18.1
1932	17.1	19.2	21.0	24.0	21.5	16.2	15.3	14.0	14.7	13.3	13.0	12.3
1933	12.8	16.1	18.0	20.0	21.5	18.0	15.0	12.7	13.0	12.7	11.5	11.2
1934	12.2	21.5	22.7	24.4	23.2	21.7	19.3	16.4	16.6	14.9	14.9	15.4
1935	16.2	22.1	24.1	24.1	24.0	21.6	18.4	16.9	18.7	18.9	18.9	18.7
1936	20.0	21.3	23.1	25.0	24.5	21.8	19.3	16.1	17.5	16.5	15.6	16.4
1937	20.7	21.8	23.9	24.8	24.8	25.5	22.4	22.7	22.7	22.0	22.0	21.0
1938	22.7	22.2	23.0	25.5	23.0	20.6	18.0	17.0	18.0	17.0	16.5	16.3
1939	16.8	17.8	20.0	20.7	19.2	21.5	17.8	14.5				
Ave.	18.62	21.95	24.33	26.22	24.97	22.55	19.65	17.86	18.52	17.47	16.9	16.33

Table 2

New York Market Prices for Broilers

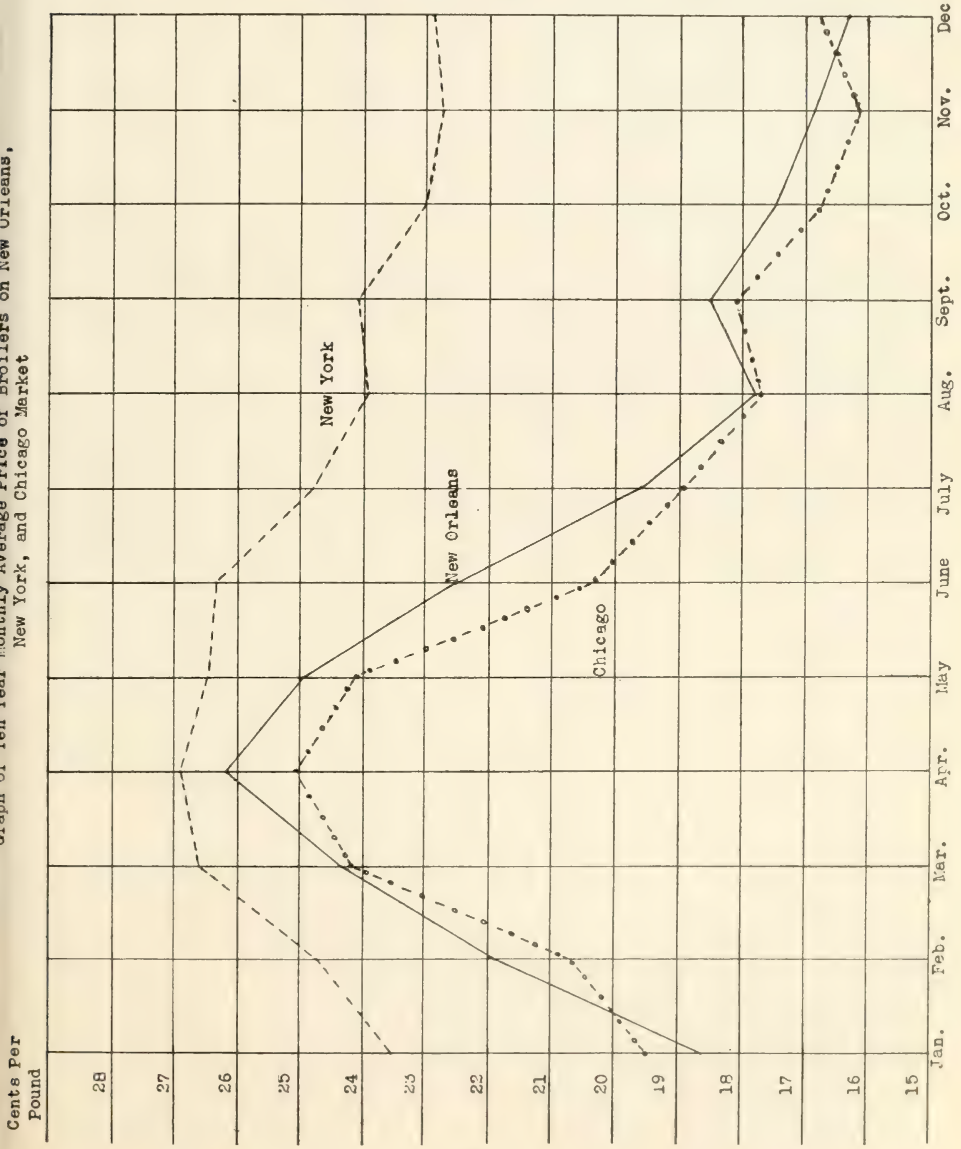
Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1930	31.5	35.0	42.3	43.0	40.0	42.0	34.0	31.5	31.0	25.0	33.3	42.3
1931	35.5	38.0	37.0	36.3	37.0	34.2	33.3	29.7	27.0	27.5	24.5	21.2
1932	20.3	21.3	27.0	25.0	25.2	22.6	22.2	19.0	20.0	19.0	20.0	17.0
1933	18.0	20.6	23.0	25.0	22.5	21.3	22.0	19.2	18.6	17.2	16.3	15.7
1934	21.5	23.5	24.7	23.0	23.0	25.8	24.7	22.7	23.0	19.7	21.0	22.0
1935	19.7	19.0	22.0	20.0	26.0	24.7	21.0	22.5	23.0	24.0	22.7	23.0
1936	25.0	24.0	24.0	27.6	21.5	25.5	23.8	23.0	23.8	22.0	18.0	18.2
1937	21.0	22.3	23.6	24.0	24.5	22.8	23.5	28.6	28.5	31.0	29.6	27.3
1938	23.0	22.2	22.7	24.7	23.5	22.7	23.0	22.0	21.5	21.6	20.5	20.2
1939	20.5	21.2	20.5	20.5	21.0	22.0	21.5	21.4				
Ave.	23.6	24.71	26.68	26.91	26.42	26.36	24.90	23.96	24.03	23.0	22.8	22.9

Table 3

Chicago Market Prices for Broilers

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1930	29.2	31.5	39.5	39.5	38.0	23.2	22.0	21.2	22.1	20.2	18.2	20.2
1931	23.0	25.4	33.7	38.2	31.2	23.0	24.7	20.2	17.0	15.0	15.8	15.7
1932	16.0	19.7	22.0	20.5	20.5	17.2	14.7	12.9	14.6	12.2	11.3	12.7
1933	12.3	13.3	12.2	13.3	14.0	14.7	10.5	11.8	10.0	8.0	7.7	8.5
1934	14.7	14.5	17.5	20.5	23.0	24.5	21.5	19.2	17.9	17.4	16.0	17.5
1935	20.5	23.2	24.7	24.8	23.9	20.7	19.2	20.4	19.6	19.2	15.9	16.5
1936	21.2	18.0	23.9	26.3	26.0	25.0	21.5	17.6	20.7	16.0	16.7	17.2
1937	21.7	23.8	25.9	24.6	24.0	19.6	21.9	23.2	24.2	25.5	26.0	26.0
1938	20.7	20.0	20.5	23.0	21.2	18.4	17.3	16.5	17.1	17.0	18.0	16.3
1939	16.0	18.2	21.3	19.5	19.4	17.3	17.0	14.7				
Ave.	19.5	20.76	24.12	25.02	24.12	20.36	18.94	17.75	18.1	16.7	16.1	16.7

Reference: Daily Times-Picayune, New Orleans, Louisiana.



Graph of Ten Year Monthly Average Price of Broilers on New Orleans, New York, and Chicago Market

Diseases and Parasites

Disease and parasites very often cause the broiler producer a great deal of trouble and expense. The most careful producer will have trouble with some disease or parasite. Every precaution should be exercised to prevent disease and parasite infection, but in many cases the precautions fail and it is necessary that the producer know how to determine the trouble and how the trouble should be treated.

The broiler producer should be careful in purchasing chicks, buying from a reliable hatchery that supplies disease free chicks. By doing this a great deal of trouble may be avoided.

Suggestive Questions

1. What are the most common diseases of broilers?
2. What causes these diseases?
3. How are they spread?
4. How may the diseases be controlled.
5. What are parasites?
6. What parasites attack chickens?
7. How do parasites spread?
8. How may parasites be controlled?

Pullorum Disease of Chicks (Bacillary White Diarrhea)

Pullorum disease is a highly fatal and contagious disease of young chicks. A large percentage of losses from diseases in chicks under three weeks of age appears to be traceable to this cause. Its ravages have rendered many flocks unprofitable.

The disease is one of the few affecting adult fowls that may be transmitted directly through the egg to the newly hatched chick. It is rare that mature stock infected with the disease show any symptoms, yet when infected hens are killed and the body cavity opened, abnormal or diseased yolks are found. Infected parent stock and contaminated incubators and brooders are largely responsible for the presence of the disease in young chicks.

The specific cause of pullorum disease is a microscopic germ know as **Salmonella pullorum.** This organism gains entrance to the chick through the digestive tract with contaminated feed or water, or, as indicated above, it may have been in the egg from which the chick was hatched. The germ is found in the blood, in the unabsorbed yolk, and in the internal organs of baby chicks following death from the disease. The droppings of affected chicks, as well as infertile or unhatched eggs from infected breeding fowls, often contain **Sallmonella pullora** in large numbers.

Conditions which tend to weaken the vitality of baby chicks are regarded as important factors in susceptibility to the disease. Proper brooding and handling of chicks from infected stock or of those exposed to the disease are regarded as helpful in reducing losses.

Symptoms in Baby Chicks. Chicks are most susceptible to the disease before they are five days old, though symptoms may not be observed for several days after exposure. Heavy losses in chicks under three weeks of age are often traceable to an acute type of the disease. Affected chicks are weak and unsteady in standing and walking. The feathers are ruffled, the eyes closed, and the wings drooping. Diarrhea usually develops with a "pasting up behind" and death follows in a few hours. Chicks suffering from an acute type of the disease, however, may die before symptoms of diarrhea appear. The absence of diarrhea, therefore, cannot be regarded as definite evidence of the absence of pullorum disease.

An accurate diagnosis of pullorum disease can be made only by laboratory examination. A flock owner who suspects the presence of the disease should send typically affected live chicks to a properly equipped laboratory for examination.

Surviving Chicks Should not be Used as Breeders: Chicks that suffer a temporary setback from a mild attack of pullorum disease, followed by apparent recovery, develop a low-grade, chronic type of the disease in the yolks of ovaries and, as mature birds will pass on the infection to young chicks in subsequent hatching seasons. **Therefore such chicks should not be kept for breeders.**

How the Disease Spreads. The part which mature infected fowls play in transmitting the disease to baby chicks through the egg has been established in experimental tests and confirmed in outbreaks of the disease in farm flocks. In fact repeated heavy losses of baby chicks unexplained by other causes are often the first suggestion of the diseases in mature fowls.

Pullorum diseases may thus be regarded as being transmitted through the egg to the chick, and from egg-infected chicks to healthy chicks through contaminated droppings in incubators, brooders, and water and feed containers. One chick infected with pullorum disease at hatching time is capable of contaminating incubators and spreading the disease to the entire brood.

While it is not definitely established that pullorum disease is commonly spread among adult hens through association with infected hens or by an infected male in breeding, it is possible that the rapid progress of the disease in some breeding flocks may be accounted for in this way.

Control of Pullorum Disease. The control of pullorum disease depends largely upon two factors: first, the detection of infected breeding fowls by means of certain tests and their removal from the flock; second, the sanitary protection of healthy chicks against infection in incubators, brooder houses, and contaminated runways.

The greatest progress in freeing flocks from pullorum disease has been made by owners who have removed infected breeding stock and applied the fundamentals of chick sanitation. In healthy, vigorous flocks, properly managed, the complete extermination of the disease is possible. In fact, several clean flocks have been established and the amount of infection greatly reduced in other flocks in which pullorum disease was found.

It is to be expected that some flock owners will be more successful than others in stamping out this disease, yet anyone can reduce losses by adopting approved methods of sanitation and testing his flock regularly.

Tests for Detecting the Disease. The testing of flocks for pullorum disease is usually done in the late fall, after culling. The value of the tests in detecting infected breeding stock over one year of age is well established, although it must be acknowledged that no biological test is perfect and that repeated tests are more valuable than a single test. The tests for pullorum disease represent but one part of the control program. In order that they may give the best results, they should be applied by skilled persons.

Reference: Illinois Agricultural Extension Service Circular 432. "Pullorum Disease of Chicks", pages 3, 4, and 6, March 1935, Urbana, Illinois.

Bronchitis

The chief symptom is gasping for breath. The disease spreads so rapidly that a few cases may be seen in a house in the morning and by night 75 to 90 per cent of the birds may be affected. Not infrequently death will take place in from a few minutes to a few hours after the first symptoms are noticed. The most typical postmortem finding is the presence of clotted blood in the trachea which is apparently the reason for the difficult breathing. In the birds that die later in the outbreak, typical diphtheritic membrances may be found in the trachea.

Treatment of mature fowls is of little avail, death usually taking place either before it can be administered or in spite of it. In baby chicks, placing in a tight compartment and applying medicated steam has seemingly been of some value. Water to which a teaspoonful of carbolic acid or oil of eucalyptus has been added can be boiled in the compartment. The steaming can be repeated at intervals of a few hours and aparently does bring some relief in the breathing, although of course it is merely palliative. Some poultrymen have sprayed the baby chicks with a harmles antiseptic. The steaming, however, seems to be fully as effective. When the disease breaks in a large flock of mature fowls it spreads so rapidly and the mortality is so high that vigorous measures must be instituted at once or the loss will be great. To stop the inroads it is better to slaughter all the mature fowls in a given house and sell those for meat that have not yet shown symptoms. The house can then be thoroughly disinfected and allowed to remain vacant for at least a month before putting other fowls into it. In a large establishment this may be repeated in each house that becomes affected. Special care must be given that attendants ministering to the sick fowls do not go into the houses where the disease has not yet developed.

Roup

Roup is highly a contagious disease affecting especially the mucous membranes of the upper air passages and the eyes. It usually affects mature birds or at least those that are half grown or over. It rarely attacks chicks under two months of age.

The cause is probably a filterable virus which is introduced in many cases by the purchase of new chickens or by bringing in birds that have been sent to shows. There are also healthy birds that have passed through a previous outbreak and are still carrying the virus. These, known as "carriers", continue the disease in a flock from year to year. Undoubtedly, the usual devitalizing influences are a considerable factor. These are exposure to cold, overcrowding, lack of ventilation, improper diet, etc. The disease is more prevalent in the winter than in the summer but may be seen at any time of the year.

The early symptoms are watering from the eyes and nose accompanied by sneezing and coughing. Later the discharges become thicker and clog the nostrils and glue the eyelids together. The lids will not be swollen and as the nostrils are closed the bird breathes through its mouth, thus drying the tongue At this time the bird droops, may refuse food, the feathers are ruffled and diarrhea may supervene. Still later the cavity just below the eye fills with an exudate that then becomes cheesy and putrid and causes a swelling of the face at this point. This swelling is particularly characteristic of roup.

The birds may die at any time during the course of the disease, the younger ones dying early and the stronger or older keeping up at times for several days and even recovering in many instances. The disease may spread rapidly through the flock with a high percentage of mortality.

The proper handling of a flock affected with roup requires decisive and energetic action. It is usually better to destroy all sick birds but if treatment is to be attempted, the sick should be isolated and as fast as others are taken sick they should be removed. If only the birds in one pen are affected, precautions should be taken to see that the disease does not spread to the rest of the flock. The houses and pens should be cleaned thoroughly and disinfected at frequent intervals and special attention should be given to the drinking vessels. Potassium permanganate or a pinch of chlorinated lime may be used in the drinking water.

Housing is recognized as a large factor in the development of roup. Damp, illy ventilated, cold and overcrowded houses must receive attention. Correction of the housing conditions will often in itself stop this disease.

If treatment is to be attempted the heads of the affected chickens may be dipped into a warm solution of any of the following:

Potassium permanganate—1 level teaspoonful to a pint of water

Chlorinated lime—a pinch of the powder to a pint of water

Hydrogen peroxide diluted 1 to 3

If there is a bulging of the face that has been present for some days it may be incised with a sharp knife, after which the cavity may be washed out with any of the above solutions.

Prevention of roup by vaccination has been tried by many investigators. Some have used the virus of chicken pox, others have made the vaccine from the bacterium that causes chicken cholera and still others from a miscellaneous group of organisms associated with roup. While some excellent results have been reported, all that can be said at this time is that vaccination against this disease is still in the experimental stage and if used at all should be used with this understanding.

Chicken Pox

The disease is characterized by warty nodules in the comb and wattles and other unfeathered portions of the head. It is largely confined to older birds, is not so common in Colorado as roup or diphtheria and is generally less fatal. There are occasional outbreaks where the mortality is quite high. It seems to have been definitely proved that the cause is a micro-organism that is too small to be seen even by the microscope. Affected birds live several days frequently recover, especially if properly treated. At times the inflamatory disturbance of the skin spreads to the mucous membranes of the mouth, forming there false yellow membranes simulating diphtheria.

Treatment consists of painting the nodules and the false membranes with tincture of iodine. In the milder cases the growths fall off; the birds recover. All sick birds should be isolated as soon as found and either treated or destroyed. Houses and pens should be cleaned and disinfected.

The California Experiment Station prepared a vaccine from the nodular growths that has been quite successful in preventing the disease. At first the vaccine was administered subcutaneously but more recently it has been shown to be more effective when placed in a scratch on the skin or applied to the point where a few feathers have been plucked. The scratch method seems preferable. Vaccination is to be recommended in the presence of this disease.

Reference: Colorado Agricultural Extension Bulletin 310A, "Diseases of Poultry", pages 18, 19, 20, 21, 22, 23, 24 and 25, January 1932, Fort Collins, Colorado.

Roundworms

The roundworms of the common fowls are largely of two varieties, those found in the intestinal tract in front of the cecum **(Ascaridia lineata)**, and those found in the cecum **(Heterakia gallinae)**. The intestinal roundworm is from 1 to 3 inches in length and may be present in such numbers as to almost fill the gut. The cecum worm is much smaller, seldom attaining more than one-half inch in length and may be found in enormous number in that organ. These round worms produce emaciation and weakness but seldom cause death. Because of the interference with nutrition, however, it is best to keep birds free from them.

The most commonly used treatment and the easiest to administer is carried out by adding tobacco dust to the mash in the proportion of 2 percent (2 pounds of tobacco dust to 100 pounds of mash) and keep this before the birds for from 1 to 2 weeks. This method of treatment when used at occasional intervals will keep down the worms but may not be as effective in individual birds as the single dose method. Some recommend nicotine sulphate but this is so poisonous that unless it is mixed with some bland substance like Fuller's earth, it will destroy the fowls. It is highly effective but should be used in a form put up commercially so that dosage and buffer can be regulated. The United States Bureau of Animal Industry recommends oil of chenopodium given by rectal injection when mixed with cottonseed oil, more especially for the cecum worm. The dose is one tenth cubic centimeter of oil of chenopodium in 5 cubic centimeters of cottonseed oil for half-grown birds. By the use of a rubber syringe it is contended that this can be injected just as easily and more efficiently than when given by the mouth.

Cleanliness means much in the prevention of worms since the eggs are continually being passed out with the droppings, and unless these are cleaned up at frequent intervals a continuous cycle will be established which will keep the chickens constantly infested. Ordinary disinfectants are of little value in the destruction of worm eggs. Their entire removal from the premises is essential if the cycle is to be broken.

Tape Worms

There are many species of tapeworms infesting the fowls, running in size from those that can be observed only by the aid of the microscope to several inches in length. Several species may be found in the same bird at the same time. These worms are easily differentiated from the round worms because they are jointed and flat. In young birds they are even more serious than the roundworms, not infequently causing death. Hall of the United States Bureau of Animal Industry has found that the best medicinal treatment is powdered kamala. He recommends the administration of 1 gram (15 grains) by the mouth either in a capsule or in the form of a tablet. Birds will swallow these quite readily when placed in the back of the mouth. This dosage is for mature fowls. Where young birds are treated, the dosage may be cut in half or even more. Kamala will destroy certain of the weak chickens and particularly any that may be suffering from deficiency disease or roup.

Tapeworms pass a part of their life cycle in insects of various kinds, particularly the common housefly. Consequently, it is better to collect the droppings at frequent intervals and treat them so that they will not be infested with flies. All measures tending to keep down the flies will also tend to break the cycle of the tapeworm. Avoid feeding liquid milk which draws flies. Milk should be allowed to clabber and drop before feeding. The addition of powdered borax to manure piles is an effective means of reducing the number of flies.

Lice

There are many species of lice infesting poultry. These insects rarely cause death in themselves but in birds depleted by other diseases they bring about much irritation and loss of flesh. Most lice are of sufficient size so that they are easily seen on examination under the wing or inside the thigh.

The treatment as recommended by the U. S. Department of Agriculture consists in the application of sodium fluoride either as a dusting powder or as a dip. Sodium fluoride can be purchased at most any drug store or poultry supply house. It may be applied directly by putting a pinch deeply into the feathers at numerous places over the body of the bird. This commonly known as the pinch method. The powder is gradually dispersed and may be expected to kill the lice within 4 or 5 days. The dipping method is more rapid in its action and possibly more effective, but it can only be used in favorable weather. The dip is made up by adding 1 ounce of sodium fluoride to 1 gallon of warm water and the hens are thoroughly dipped so that all portions of the body are reached. This method usually results in the destruction of the lice within 24 hours but where infestation is severe it is better to repeat it in one week.

Mites

Common red mites of the fowl **(Dermanyssus gallinae)** are night prowlers, usually leaving the birds before morning and spending the day hidden away from the light in the cracks under the roosts. For this reason they are easily attacked. By way of prevention it is better to have the roosts set in slots so that they can be readily removed at frequent intervals. The mites can then be sprayed directly with some injurious oil. Waste cylinder oil from automobiles, to which has been added a pint of kerosene will kill the mites but it may require frequent applications because of its thinner body. Crude petroleum and creosote are also effective.

Coccidiosis

This is a parasitic disease of chickens and other fowls which is very wide spread and highly destructive, especially to half-grown chickens. It is most fatal in chicks from 2 to 10 weeks of age. In older birds, particularly during the first winter, it sometimes causes leg weakness and finally death. The cause is a one celled animal of microscopic size that is present in large numbers in the droppings of affected birds. The parasite is spread by contamination of the drinking water and the feed, by means of the droppings of the diseased individuals.

The younger chickens show a bloody diarrhea, great weakness and die in from 1 to 5 days. The older birds lose weight, the comb and wattles become pale and finally the birds become unable to stand on their legs. They usually die only after several days or weeks.

Since it has been shown that the parasites are not capable of affecting other birds for 2 or 3 days after they are discharged, daily cleaning of the brooders, pens and houses will go far toward eliminating the disease. Where it is possible, the diseased birds should be destroyed and the well ones moved to entirely new ground. Where this is not possible, daily cleaning with occasional disinfection will help materially. Among these has been bichloride of mercury (corrosive sublimate) in the proportion of a 7 and one-half-grain tablet to a gallon of water and powdered crude catechu, one-third teaspoon to the gallon of water.

The California station seems to have made the most progress in handling the malady by the addition of large quantities of milk to the ration. They showed that the organism did not develop in the intestines if a certain acidity could be maintained. This was best brought about by the addition of milk, either in the form of fresh milk, dried milk or dried buttermilk. It was shown to be essential, however, that milk comprise at least 40 percent of the ration. If it is to be used as whole milk, no water should be given the birds as otherwise they will not take sufficient quantity. They recommend the following ration where dried skimmilk is to be used.

Dry skimmilk	40 pounds
Wheat bran	10 pounds
Yellow corn meal	30 pounds
Ground barley	20 pounds

The milk should be continued for 2 or 3 weeks after the outbreak.

It seems that we must look upon coccidia as being always present to some degree in our mature fowls and in the soil of our poultry yards. The real problem is then, by better sanitaiton, to hold down the number of coccidia ingested until the young birds have developed a resistance to their presence.

Reference: Colorado Extension Service Bulletin 310A, "Disease of Poultry", pages 34, 35, 36 and 37, January 1932, Fort Collins, Colorado.

Bulletin No. 336 August, 1939

The Value of Legumes for Soil Improvement

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Summary and Conclusions

Practically all of the soils in Mississippi are deficient in nitrogen. Mississippi farmers are supplying this element necessary to maximum crop production from (a) commercial nitrogen and (b) legume nitrogen. More than one million dollars was spent for winter legume seed and inoculation in 1938, and considerably in excess of this amount was spent for commercial nitrogen during the same year.

In an investigation of the economy of legumes for soil improvement, the Mississippi Experiment Station conducted a series of experiments, extending over periods of five years or more, and including major soils of the state. Summer legumes and winter legumes of the kinds and varieties most commonly planted were utilized in these tests and their efficiency measured by relatively increased yields of succeeding commercial crops of cotton or corn. The commercial crops were uniformly fertilized usually with either 400 pounds or 600 of 0-8-4 fertilizer per acre when following legume crops; whereas commercial crops on the non-legume plots were supplied also with commercial nitrogen at the rate of 24 pounds or 36 pounds of commercial nitrogen. Thus, non-legume plots received 400 pounds 6-8-4 fertilizer in some instances and 600 pounds in other instances, while corresponding legume plots received the same qualities of fertilizer but with the nitrogen omitted. Thus, a direct comparison was enabled, as between legume nitrogen and commercial nitrogen.

The data presented in this bulletin show:

1. That for cotton production in the hill sections of Mississippi legume nitrogen secured from turning under a good crop of winter legumes was approximately equal to 24 pounds of commercial nitrogen, secured from 150 pounds of 16% nitrogen fertilizer material.

2. That for corn production in the hill sections of Mississippi legume nitrogen secured from turning under a good crop of winter legumes was approximately equal to 24 to 32 pounds of commercial nitrogen, secured from 150 to 200 pounds of 16% nitrogen fertilizer material.

3. That summer legumes inter-planted with a commercial crop such as corn, while having an apparent value in increasing total feed production, have little effect in soil improvement. When not inter-planted with commercial crops, other summer legumes, namely crotalaria and kudzu, seemingly have a definite value in soil improvement.

4. The cost of winter legumes for soil improvement purposes include approximately $2.00 for seed and $1.50 for other legitimate crop costs. The cost of the corresponding quantities of commercial nitrogen is approximately the same.

5. Improved farm practices, with reference to fertilizer and lime, and with reference to reducing out-of-pocket costs by seed production on the farm when practicable, may add considerably to the ultimate economic value of winter legumes.

6. Further investigation into the utilization of winter legumes is being planned, such studies to include the partial or complete use of winter legumes for grazing, hay, and silage.

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The Value of Legumes for Soil Improvement

By RUSSELL COLEMAN, Assistant in Soils

Practically all of the soils in Mississippi are deficient in nitrogen, and most crops will not grow well until this element is supplied. Nitrogen may be supplied in two ways: first, by applying commercial nitrogen, and second, by growing leguminous crops which are able to take nitrogen from the air and store it in the soil. Nitrogen is expensive plant food, and it is important that the farmer obtain this element from the most economical source.

Growing legumes for soil improvement has become an important practice. Government benefit payments have minimized the out-of-pocket cost of planting, and have enabled a steadily increased use of both summer and winter legumes. Mississippi farmers have fallen in line with the legume program and have increased their use of legumes by approximately 500 per cent in the last three years. Many of these farmers have been successful in growing leguminous crops and have received substantial benefits from legume nitrogen as measured by increased production of succeeding commercial crops. Some have failed in growing legumes and have continued using commercial nitrogen. Others have never planted legumes and will not grow them for soil improvement because "they are too much trouble". However, everyone is interested in obtaining nitrogen at its lowest cost and is anxious to know the relative value of leguminous and commercial nitrogen.

Many long time experiments have shown the value of legumes in a crop rotation. In Georgia, over a period of 8 years, cotton following Austrian winter peas has yielded 1346 pounds of seed cotton per acre, while cotton following no cover crop has only yielded 744 pounds per acre. In Alabama, cotton and corn yields have been doubled by turning under vetch. Similar results have been obtained in other states. The value of winter legumes for soil improvement is well established.

Until recently summer legumes have not received much attention except as interplanted with commercial crops, because few farmers could afford to grow them when a cash crop was needed. However, since cotton acreage has been reduced and the Soil Conservation program has encouraged growing summer legumes, many farmers have planted them.

Summer legumes have also proved their value in certain sections and have been reported to increase cotton yields as much as 50%. The value of summer legumes for soil improvement, however, is not so well established. Unfortunately much of the nitrogen which they store in the soil is lost before another crop can use it, and often very little benefit is obtained from summer legumes.

The value of legumes to succeeding crops varies greatly, depending upon the use made of the legume crop, as well as upon the soil, the climate, and the kind of legume grown. Legumes produced for soil improvement are customarily plowed under for green manuring purposes, and the data presented in this bulletin refer primarily to legumes plowed under rather than those utilized for hay, or grain, or any other purpose. It is commonly accepted that when incorporated with the soil, all legumes add organic matter and improve the physical make-up of the soil. Leguminous plants also tend to protect the soil from erosion, though data are not sufficiently conclusive to substantiate this prevailing impression.

But what is the ultimate purpose of soil improvement, whether by means of winter legumes or commercial fertilizer? The ultimate and only purpose of soil improvement is increased crop yields, and any justifiable investment made by the farmer for soil improvement must be reflected in increased crop yields. Therefore, crop yields from long-time experiments on many different soils should be given as the measure of the real value of legumes for soil improvement.

Many experiments have been conducted by the Mississippi Agricultural Experiment Station to determine the value of legumes and to find their economic place in a crop rotation system. Some soils have responded better than others, but under a wide variety of conditions crop yields have uniformly shown a decided increase where legumes have been used. Thousands of farmers have obtained valuable benefits from legumes and are giving them a permanent place in their cropping system. More than any other factor, they have shown our farmers the importance of restoring the nitrogen which is so essential to crop production. Growing legumes has encouraged the use of commercial fertilizer, and has helped in developing a well rounded cropping program. On many farms where legumes are planted, crop yields have been doubled, new houses have been built, new cars bought, and the standard of living raised 100 per cent. The value of these things cannot even be estimated, but we know that they have meant millions of dollars to our people. Therefore, it is unnecessary to discuss at length the merits of legumes. They have already proved their value.

It should be emphasized that soil improvement is done at considerable cost by farmers, whether such soil improvement is accomplished by the use of legumes or by the purchase of commercial fertilizer. The investment made by Mississippi farmers in legume seed alone during recent years is probably not less than $1,000,000 annually. The investment made by Mississippi farmers in commercial nitrogen considerably exceeds the investment in winter legume seeds.

Annual investments of these large proportions seem to justify, even to require, an examination to determine their relative merits. In view of the fact that the nitrogen so vitally needed by crops may be secured either from legumes turned under or from commercial nitrogen materials, the farmer is justified in asking, "How shall I invest my money for greatest returns?"

It is the purpose of this bulletin to compare the cost and efficiency of legumes and commercial nitrogen as reflected in increased crop yields, and to discuss other and closely related phases of legume production.

In most cases, Delta soils have responded more favorably to legumes than soils of the hill section of Mississippi. Therefore, results from the two sections will be discussed separately. Only results obtained in the hill section of Mississippi will be discussed in this bulletin, and results from the Delta section will be discussed later in a separate bulletin.

For a period of recent years a series of soil fertility experiments have been conducted by the Mississippi Agricultural Experiment Station at State College and by its Branch Stations at Holly Springs, Natchez, Poplarville, and Raymond. These experiments have included: (1) The use of commonly grown legumes, (2) uniform fertilizer treatments, (3) comparisons, sometimes with unfertilized check plats and always with check plats supplied with nitrogen from commercial sources rather than from legume sources, (4) yield responses made by succeeding commercial crops.

Influence of Legume Nitrogen and Commercial Nitrogen on Yields of Cotton

Soils do not respond alike to applied nitrogen, whether such nitrogen is secured from legumes or commercial sources. In many soils nitrogen is not the limiting factor, and naturally these soils will not respond as well to nitrogen as in those where nitrogen is the limiting factor. In a five-year test on Grenada silt loam at the Holly Springs Branch Station (table 1), cotton following no legume yielded 598 pounds of seed cotton per acre, cotton following austrian winter peas yielded 818 pounds, and cotton fertilized with 24 pounds of commercial nitrogen yielded 991 pounds of seed cotton per acre. In a 9-year test on Lintonia silt loam (table 7) cotton following no legume yielded 605 pounds of seed cotton per acre, cotton following hairy vetch yielded 1178 pounds, and cotton fertilized with 36 pounds of nitrogen yielded 1342 pounds of seed cotton per acre. Both of these soils were deficient in nitrogen and responded well to legumes and to commercial nitrogen. The response to nitrogen on Olivier silt loam at Raymond (table 1) was considerably less.

A similar test on Ochlockonee sandy loam at State College shows that cotton following no legume yielded 857 pounds, cotton following winter peas yielded 916 pounds, and cotton fertilized with 36 pounds of nitrogen yielded 1021 pounds seed cotton per acre. Results of these tests are summarized in table 1:

TABLE 1—EFFECT OF AUSTRIAN WINTER PEAS AND COMMERCIAL NITROGEN ON COTTON YIELDS

Plat No.	Treatment	Holly Springs* Grenada Silt Loam	Raymond** Olivier Silt Loam	State College** Ochlockonee Sandy Loam
		5-Year Average in Pounds Seed Cotton		
1	Cotton Continuously	598	1105	857
2	Cotton After Austrian Peas	818	1199	916
3	Cotton With Commercial Nitrogen	991	1281	1021

*All plats received 400 lbs. 0-8-4 under cotton. Plat 3 received 24 lbs. nitrogen.
**All plats received 600 lbs. 0-8-4 under cotton. Plat 3 received 36 lbs. nitrogen.

Ochlockonee is a good bottom soil, high in nitrogen, and it responded very little to legumes or commercial nitrogen. It will be noted that good response to nitrogen was secured on two of the soils, and poor response was secured on two of the soils. Therefore, it appears that the value of a legume to a following crop, as well as of commercial nitrogen, depends largely upon the natural fertility of a soil. This work suggests the need that every farmer make comparison of his own soil to determine the response of the crops to nitrogen.

Comparisons of Five Soils

During the 5-year period, 1934-1938, uniform tests were conducted by the Central station at State College and by the Branch Stations at Holly Springs, Natchez, Poplarville, and Raymond in which three widely planted winter legumes were used in a 1-year rotation with cotton and compared with each other and with cotton treated with 24 pounds of nitrogen per acre. The comparisons include results from treatments on four soil types; namely, (1) Grenada silt loam, (2) Memphis silt loam, (3) Ruston sandy loam, and (4) Olivier silt loam. These soils are widely prevalent in the hill section of Mississippi.

Uniformly throughout these tests, cotton was produced upon the same plat during all of the 5 years; the winter legume seed being planted in the fall after the cotton crop was matured, and turned under in the spring in time for the planting of another cotton crop. All plats were fertilized with 400 pounds of 0-8-4 per acre. The legume plats received no nitrogen, while the no legume or check plats received 24 pounds of nitrogen per acre, applied with the 0-8-4 making a 6-8-4 mixture. Therefore, a comparison is possible between yields from plats receiving their nitrogen from legumes and those receiving their nitrogen from commercial sources. Results are shown in table 2.

TABLE 2—EFFECT OF VARIOUS WINTER LEGUMES AND COMMERCIAL NITROGEN ON COTTON YIELDS FROM 4 SOIL TYPES

Plat No.	Treatment	Holly Springs Grenada Silt Loam	Natchez Memphis Silt Loam	Poplarville Ruston Sandy Loam	Raymond Olivier Silt Loam
		5-Year Average Yields in Pounds Seed Cotton Per Acre			
1	Cotton after Hairy Vetch	1292	2095	356	1251
2	Cotton after Austrian Peas	1280	2144	385	1182
3	Cotton after Crimson Clover	1192	2018	370	1085
4	Cotton after 24 lbs. Commercial Nitrogen	1270	2085	397	1254

All plats received 400 pounds 0-8-4 before cotton was planted in the spring. Plat 4 received commercial nitrogen mixed with 0-8-4.

Three of the four soils in this test were better than average, but all of the four soils gave a similar response. Nowhere is there any considerable difference between the best of the plats receiving nitrogen from a legume source or from 24 pounds of commercial nitrogen. From these four tests conducted over a five-year period at widely separated points in Mississippi, it seems clearly apparent that a good crop of winter legumes is approximately equivalent to 24 pounds of commercial nitrogen. Similarly, 24 pounds of commercial nitrogen is approximately equivalent to a good crop of winter legumes turned under.

Similar results were shown in another test conducted during the 5-year period 1934-1938. On Grenada silt loam soil at Holly Springs, cotton following austrian peas yielded 1265 pounds seed cotton per acre, while cotton fertilized with 16 pounds of commercial nitrogen yielded 1205 pounds seed cotton per acre. These results are shown in table 3.

TABLE 3—EFFECT OF AUSTRIAN PEAS AND COMMERCIAL NITROGEN ON FOLLOWING COTTON YIELDS

Plat No.	Treatment	Holly Springs Grenada Sandy Loam
		5-Year Average in Pounds Seed Cotton Per Acre
1	Cotton after Austrian Peas	1265
2	Cotton with 16 lbs. Commercial Nitrogen	1205

Both plats received 400 lbs. 0-8-6. Plat 2 received Commercial Nitrogen mixed with 0-8-6.

Summary of Cotton Experiments

Results shown in the foregoing Tables, 1, 2, 3, and in Table 7 which follows, in the opinion of the author and in the opinion of other Experiment Station workers who supervised the tests, present a true picture of the soil improvement qualities of winter legumes as compared with the soil improvment qualities of commercial nitrogen. There are variations in responses, it is true, in some cases the legume nitrogen yielding more than the commercial nitrogen, and in some cases the commercial nitrogen yielding more than the legume nitrogen. A careful study of the tables, however, warrants one general conclusion based upon this series of experiments on five principal cotton soils in the hill section of Mississippi, each conducted over a sufficient number of years to equalize seasonal variations: a good crop of winter legumes increases cotton yields about the same as 24 pounds of commercial nitrogen.

Influence of Legume Nitrogen and Commercial Nitrogen on Yields of Corn

Corn is planted on more than one-third of the cultivated area of Missis-sipppi, which indicates the importance of corn in the state farming program. Average per acre yields throughout the state have been poor. Numerous tests have shown that nitrogen is necessary for corn production, and that corn being a more vigorous growing plant than cotton, must utilize from 24 to 32 pounds per acre either of commercial or legume nitrogen for maximum yields. Experiments conducted on several soil types have shown the value of winter legumes.

A five year soil fertility test, as measured in yields of corn, was conducted under similar conditions by the Mississippi Agricultural Experiment Station through its branch stations at Holly Springs, Natchez, and Raymond. The plan of the experiment and five-year average yields are set forth in table 4 which follows:

TABLE 4—EFFECT OF NITROGEN AND OF LEGUME AND NON-LEGUME COVER CROPS ON CORN

Plat No.	Treatment	Holly Springs Grenada Silt Loam	Natchez Memphis Silt Loam	Raymond Lintonia Silt Loam
		5-Year Average Yield in Bushels Per Acre		
1	Corn with 30 lbs. Nitrogen	33.6	35.8	21.2
2	Corn after Austrian Peas	24.4	41.6	20.0
3	Corn after Rye	17.1	23.4	13.2
4	Corn with 30 lbs. Nitrogen after Rye	30.4	32.7	21.0
5	Corn alone (check)	18 9	28.4	14.9

No fertilizer was used except on plats 1 and 4 which were side dressed with 188 lbs. of sodium nitrate (30 lbs. of Nitrogen.)

Reference to table 4 will reveal that turning under austrian peas for five years on Grenada silt loam, increased the following corn yield from 18.9 bushels on the check plat to 24.4 bushels on the austrian peas plat; on Lintonia silt loam, from 14.9 bushels to 20 bushels; and on Memphis silt loam from 28.4 to 41.6 bushels. Likewise the application of commercial nitrogen had a marked effect upon corn yields. On Grenada and Lintonia soils, 30 pounds of commercial nitrogen (derived from 188 pounds of Sodium Nitrate) increased the corn yield more than austrian peas, while on Memphis soil the nitrogen from austrian peas was more effective.

In a similar test conducted by the Central Station at State College on Ocklockonee sandy loam for 9-years, corn following austrian peas has averaged 33.8 bushels and corn side-dressed with 200 pounds of sodium nitrate has averaged 33.6 bushels per acre, while corn from the check plat which received no nitrogen averaged only 25.3 bushels per acre. These results are shown in table 5.

TABLE 5—EFFECT OF AUSTRIAN WINTER PEAS AND COMMERCIAL NITROGEN ON CORN YIELDS

Plat No.	Treatment	State College Ochlockonee Sandy Loam
		9-Year Average Yield in Bushels Per Acre
1	Corn with 200 lbs. Sodium Nitrate	33.6
2	Corn after Austrian Winter Peas	33.8
3	Corn Alone	25.3

No fertilizer was used except on plat 1 which was side dressed with 200 lbs. sodium nitrate (32 lbs. Commercial Nitrogen).

In still another test made on Olivier soil at Raymond, corn following hairy vetch has yielded 29 bushels per acre while corn side-dressed with 24 pounds of nitrogen has yielded 31 bushels per acre.

In a 10-year test at State College (table 6), hairy vetch has increased the corn yield from 30.6 bushels per acre on the untreated plat to 38.1 bushels on the hairy vetch plat, and Crimson clover has increased the yields from 30.1 bushels per acre on the untreated plat to 33.1 bushels per acre on the Crimson clover plat. In this test turning under rye (a non-legume) has slightly decreased the yield. Rye has also decreased the corn yields on the Grenada, Memphis, Ruston, and Lintonia soils as shown in the preceding table 4.

TABLE 6—EFFECT OF HAIRY VETCH, CRIMSON CLOVER, AND RYE ON CORN YIELDS

Plat No.	Treatment	State College Ochlockonee Sandy Loam
		10-Year Average Yield in Bushels Per Acre
1	Corn after Hairy Vetch	38.1
2	Corn after Crimson Clover	33.4
3	Corn after Rye	30.0
4	Corn alone	30.6

No fertilizer applied to any plat.

Summary of Corn Experiments

All of these experiments indicate that nitrogen requirements for corn are similar to those previously shown for cotton: that nitrogen derived from legume sources or from commercial sources enables substantially increased production, and that a good crop of legumes turned under has a value approximately that of 24 to 32 pounds of nitrogen secured from commercial sources.

Types of Winter Legumes Most Profitable Under Mississippi Conditions

The results in the preceding tables and in table 7 show that no one legume is best for all soils. For the hill section as a whole, hairy vetch, and austrian peas have proved most reliable. Most experiments comparing hairy vetch with Austrian peas show very little difference in their value. Hairy vetch seems to be more resistant to diseases and winter freezes; Austrian peas mature about two weeks earlier, allowing earlier planting of cotton.

TABLE 7—EFFECT OF DIFFERENT WINTER LEGUMES AND COMMERCIAL NITROGEN ON COTTON

Plat No.	Treatment	Raymond Lintonia Silt Loam 9-Year Average	State College Ochlockonee Sandy Loam 7-Year Average
		Yield in Pounds Seed Cotton Per Acre	
1	Cotton after no legume	695	1045
2	Cotton after 36 lbs. Commercial Nitrogen	1342	1169
3	Cotton after hairy vetch	1178	1098
4	Cotton after Austrian peas	954	1116
5	Cotton after Monantha Vetch	912	1053
6	Cotton after crimson clover	879	1045
7	Cotton after bur clover	838	1025

All plats received 600 lbs. 0-8-4 under cotton. Plat 2 received commercial nitrogen mixed with 0-8-4, making a 6-8-4 mixture.

Another promising legume which is increasing in popularity is bur clover. Many hill farmers have had trouble getting it established and have become discouraged, but by proper fertilization and care a crop can be grown successfully on most soils. However, many soils are not suited for its growth. In a seven-year test at State College on Ochlockonee sandy loam, a soil high in natural fertility, a good bur clover crop was never obtained. Bur clover has two advantages over other legumes. Its seed can be saved at a very low cost, and it can be turned under at an earlier date in the spring. There are also disadvantages to planting bur clover. Experiments have shown that a good crop normally supplies more nitrogen to the soil than either hairy vetch or austrian peas, but it does not increase the following crop yield as much as either (Service Sheet No. 239).

Crimson clover has done exceptionally well in certain sections of the state, and at Natchez has produced as much as 500 pounds of seed per acre. However, it has been more valuable for grazing livestock than for soil improvement. Results at various stations indicate that the amount of nitrogen turned under does not altogether determine its effect upon the following crop. Nitrogen from some legumes seems more efficient than that from others.

One of the most important practices is to turn under a legume crop as early as possible. No exact date can be set because the climate determines the growth made. The crop is often turned when it has reached the full bloom stage, but getting greater amounts under is not as important as obtaining an efficient use of the crop already present. Results in Alabama (Bulletin 232) have shown that 4542 pounds of vetch (green weight) turned April 5 increased the yield of seed cotton more than did 9757 pounds turned April 20. Waiting too long to plow under a legume not only delays the planting of another crop, but also increases the damage of insects, which infest heavy legume crops after the first of April.

Winter legumes should be planted from September 1 to November 1. An ideal time for planting is after a rain in late September. Plantings made too early in September may be destroyed by dry weather. Late plantings may be destroyed by the cold of early winter. In order to insure a successful crop it is necessary to inoculate legume seed unless the necessary bacteria have already been established and are present in the soil.

Fertilizer Requirements for Optimum Growth of Winter Legumes

Like all other plants, legumes require a certain amount of food, and if it is not present in the soil it must be supplied from some other source. Winter legumes are heavy feeders on phosphorus, and on average hill soils 32 pounds of phosphorus (200 pounds superphosphate or 400 pounds of basic slag) will usually double its yield. An average of 102 tests conducted by Mississippi Extension Service (Bulletin 101) show that vetch without fertilizer yielded 7816 pounds of green matter per acre, vetch with 100 pounds of triple superphosphate (39 pounds of P_2O_5) 13,255 pounds. Excellent response has also been obtained from the phosphorus applied to a preceding cotton crop. Table 8 shows the residual effect of phosphorus and lime on hairy vetch when tested on seven soils:

TABLE 8—RESIDUAL EFFECT OF PHOSPHORUS AND LIME ON HAIRY VETCH

Plat No.	Fertilizer Applied to Cotton	3-Year Averages of 7 Tests on 7 Soils
		Yield of Hairy Vetch in Green Weight Per Acre
1	400 lbs. 4-8-4 (32 lbs P_2O_5)	7889
2	400 lbs. 4-8-4 + 400 lbs. lime	9929
3	400 lbs. 4-0-4 (No phosphate)	4464

The phosphorus applied to cotton almost doubled the following hairy vetch yield and phosphorus and lime under cotton more than doubled the following vetch yield. These results suggest the importance of fertilizing and liming winter legumes. Legumes remove large amounts of lime, and they will not grow well on soils whose base (lime) supply has been exhausted. Where legumes are planted continuously it is necessary to apply lime in order to replace that which is being lost from the soil.

By fertilizing both winter legumes and the following crop with heavy appplications of phosphorus and potash, Alabama workers have found that winter legumes increase crop yields as much as 40 to 46 pounds of commercial nitrogen. In this test (Bulletin 232, Alabama Experiment Station, Auburn, Alabama) legume plats received 400 pounds of superphosphate and 100 pounds of muriate of potash in the fall when planted, 200 additional pounds of superphosphate before the cotton was planted in the spring, and 1 ton of lime per acre every five years. On the no-legume plats, identical amounts of superphosphate and muriate of potash were used, plus 325 pounds of nitrate of soda. No lime was used on no legume plats. Thus, the cotton following legumes received 600 pounds of superphosphate, 100 pounds muriate of potash, and 400 pounds of lime. Those following no legumes received 600 pounds of superphosphate, 100 pounds muriate of potash, plus 325 pounds nitrate of soda, but did not receive an application of lime.

Had fertilizers been applied in these quantities in the Mississippi experiments reported in this bulletin, it is possible that results might have shown a good crop of winter legumes plowed under to be worth more than the commercial nitrogen equivalent shown. It was the intent, however, to conduct these experiments on a basis applicable to actual farm conditions in Mississippi. It seems likely that not many Mississippi farmers, in the light of prevailing crop prices, would be willing to invest either 1050 pounds of fertilizer, or 700 pounds of fertilizer, plus 400 pounds of lime, plus a legume crop in one acre of cotton.

Effect of Summer Legumes and Commercial Nitrogen On Yields of Cotton and Corn

For many years farmers have planted small amounts of summer legumes for soil improvement, but since cotton acreage has been reduced, many acres of the poorest soils have been planted to summer legumes in order to comply with the soil conservation program. Soybeans and cowpeas are probably the most popular summer legumes, for beside being soil builders they are also valuable food for both man and animal. Soybeans and cowpeas are often cut for hay, and as long as most of the crop is removed, one cannot expect to improve the soil very much. Experiments have shown some interesting results.

TABLE 9—EFFECT OF SOYBEANS AND COMMERCIAL NITROGEN ON COTTON YIELDS

Plat No.	Treatment	Holly Springs* Grenada Silt Loam	Raymond** Olivier Silt Loam	State College** Ochlockonee Sandy Loam
		5-Year Average in Pounds Seed Cotton		
1	Cotton Continuousuly	597	1105	857
2	Cotton with Commercial Nitrogen	991	1281	1021
3	Cotton after Soybeans Cut For Hay	657	1159	841
4	Cotton after Soybeans For Hay and A. P.	802	1154	844
5	Cotton after Soybeans For Grain	683	1179	966
6	Cotton after Soybeans For Grain and A P.	863	1206	907

*All plats received 400 lbs. 0-8-4 under cotton. Plat 2 received 24 lbs. nitrogen.

**All plats received 600 lbs. 0-8-4 under cotton. Plat 2 received 36 lbs. nitrogen.

At Holly Springs, cotton every year for 5 years has averaged 597 pounds seed cotton per acre, cotton following soybeans cut for hay 657 pounds, and cotton following soybeans threshed for grain has averaged 683 pounds seed cotton per acre. At Raymond cotton every year has yielded 1105 pounds seed cotton per acre, cotton following soybeans cut for hay 1159 pounds, and cotton following soybeans threshed for grain has averaged 1179 pounds seed cotton per acre. On Ochlockonee sandy loam, at State College cotton continuously for 7 years has averaged 857 pounds seed cotton per acre; cotton following soybeans cut for hay has averaged 841 pounds; and cotton following soybeans threshed for grain has averaged 966 pounds seed cotton per acre. On Ruston sandy loam, cotton every year for 5 years has yielded 740 pounds; cotton after soybeans cut for hay has yielded 788 pounds; and cotton after soybeans for grain has yielded 890 pounds seed cotton per acre. In an 8-year test conducted on Ocklockonee sandy loam cotton continuously has yielded 917 pounds per acre, and cotton following different varieties of soybeans has yielded as follows: after Otootans 877 pounds seed cotton per acre, after Mammoth Yellow 881, and after Laredo 838 pounds seed cotton per acre. Results are shown in table 10.

TABLE 10—EFFECT OF DIFFERENT VARIETIES OF SOYBEANS ON COTTON YIELDS

Plat No.	Treatment	State College Ochlockonee Sandy Loam
		8-Year Average in Pounds Seed Cotton
1	Cotton Continuously	917
2	Cotton following Otootans cut for hay	877
3	Cotton following M. Yellow cut for hay	881
4	Cotton following Laredos cut for hay	838

All plats received 600 lbs. of 0-8-4 every year.

In this particular test, removing the hay of all varieties decreased the following cotton yield, but the decrease was not as great where Mammoth Yellow and Otootan varieties were planted.

The above tests show that the effect of soybeans on the following cotton crop depends upon the nature of the soil. They suggest that the soil cannot be improved very much by removing the hay and indicate that excellent increases may be obtained on some soils by turning under the crop. However, in every case 24 pounds of commercial nitrogen increased the following cotton yield more than turning under the soybeans. Therefore, if hay is needed for livestock, soybeans will probably be more valuable as feed than as a soil builder.

Soybeans are often interplanted with corn to "build-up" the soil and at the same time secure additional food for livestock. This is an excellent way to obtain large amounts of grain, but experiments have shown that it is a poor way to increase corn yields. Table 11 shows the effects of interplanting soybeans upon corn yields on four soils:

TABLE 11—EFFECT OF INTERPLANTING SOYBEANS UPON CORN YIELDS

Plat No.	Treatment	Holly Springs* Grenada Silt Loam	Natchez* Memphis Silt Loam	Raymond* Lintonia Silt Loam	State College** Ochlockonee Sandy Loam
		Average Yield in Bushels Per Acre			
1	Corn alone (check)	18.9	28.4	14.9	25.3
2	Corn with Soybeans in Drill	15.9	29.0	12.1	24.1
3	Corn Side Dressed with Nitrogen	33.6	35.8	21.2	33.6

*5-Year Averages—No fertilizer applied except 30 lbs. Commercial Nitrogen on Plat 3.

**9-Year Average—No fertilizer applied except 32 lbs. Commercial Nitrogen on Plat 3.

A nine year test at State College shows that corn planted with soybeans yielded 24.1 bushels, corn planted alone 25.3 bushels. A similar test at Holly Springs for five years shows that corn with soybeans averaged 15.9 bushels, corn alone 18.9 bushels. At Raymond, corn with soybeans yielded 12.1 bushels, corn alone 14.9 bushels.

In another test, conducted at Holly Springs, Poplarville, and Raymond, two summer legumes and two planting dates were compared to determine effect upon corn yields. Results are carried in Table 12:

TABLE 12—EFFECT OF CROTALARIA AND SOYBEANS UPON CORN YIELDS

Plat No.	Treatment	Holly Springs Grenada Silt Loam		Poplarville Ruston Sandy Loam	Raymond Olivier Silt Loam
1	Corn every year	8.5	17.4	10.6	19.7
2	Crotalaria in drill one year, corn next	21.9	25.5	14.8	24.4
3	Corn and Crotalaria in same drill	12.5	16.3	9.9	15.9
4	Corn with Crotalaria in middle at lay by	10.1	19.1	15.8	20.5
5	Corn and Soybeans in Same Drill	8.4	13.5	14.0	17.2
6	Corn with Soybeans at lay by	11.6	19.6	13.4	18.3
	Fertilizer treatments, all plats	400 lbs. 2-8-4	400 lbs. 6-8-4		400 lbs. 4-8-4

On Olivier silt loam, corn with soybeans yielded 17.2 bushels, corn alone 19.7 bushels. On one soil, Ruston sandy loam, the corn yield was increased from 10.6 to 14.0 bushels by interplanting soybeans, and on Grenada silt loam, corn interplanted with soybeans yielded 8.4, corn alone 8.5. However, land that will not produce more than 8 or 10 bushels of corn cannot be profitably planted to corn. It should either be put in permanent pasture, or planted altogether to a soil improvement crop.

Ten-year results at Raymond (Table 13) show that corn with soybeans yielded 27.7 bushels, corn alone 28 bushels, and corn with cowpeas at "lay by time" 31.9 bushels.

TABLE 13—EFFECT OF SUMMER LEGUMES PLANTED AT DIFFERENT DATES ON CORN YIELDS

Plat No.	Treatment	Raymond Collins Silt Loam
		10-Year Average Yields in Bushels Per Acre
1	Corn alone	28.0
2	Corn interplanted with soybeans	27.7
3	Corn with cowpeas at "lay by"	31.9

The results in table 12 also indicate that summer legumes planted at "lay by time" slightly increase corn yields. However, very little plant growth is obtained from seed planted this late, and the benefit probably will not pay for the cost. When soybeans are planted with corn, there is constant competition between the two plants for moisture in the soil. If there is enough moisture for both plants, the corn may receive a beneficial effect from the soybeans, but if there is not sufficient moisture, one or both of the plants is likely to suffer. Therefore, the corn yield is often "cut" by interplanting soybeans. However, the total grain is usually greater when soybeans are interplanted.

Crotalaria and Kudzu have also proved valuable summer legumes, especially for soils which are too poor to cultivate. As soil builders, both have advantages over soybeans. Crotalaria reseeds itself every year, thus making the planting cost very small. Then too, cattle will not eat it, which allows the whole crop for soil improvement, and makes it unnecessary to fence the crop. Kudzu forms a cover for the soil all during the year. Being a perennial it resumes its growth every spring, thereby making the first planting the only one. Excellent results have been obtained from cotton and corn following kudzu, and besides being a soil builder it is a valuable forage crop. Crotalaria has also proved valuable in a crop rotation system. In a five year test at Holly Springs (table 12) corn every year has yielded 8.5 bushels; corn rotating with crotalaria has yielded 21.9 bushels every other year. At Raymond, corn every year has yielded 19.7 bushels; corn following crotalaria 24.4; and in a 5 year test at Poplarville corn alone has averaged 10.6 bushels, while corn with crotalaria at lay by time averaged 15.8 bushels. These results suggest that crotalaria is an excellent soil improvement crop, especially for soils yielding only 8 or 10 bushels of corn per acre.

Summary: Summer Legumes

Summer legumes have a definite place in our cropping system, but it depends upon their usage as to which one should be planted. Many farmers believe that the most profitable method of improving soil with summer legumes is to grow food-stuff, feed it to livestock, and return the manure to the soil. If there is enough livestock to utilize the food and if the manure can be saved, this might be the most profitable way. For farmers interested in obtaining food-stuff, soybeans and cowpeas should be planted. For those interested only in "building up" the soil, some permanent legume should be planted. On certain soils crotalaria and kudzu have proved excellent soil builders. There are many soils which should not be in cultivation, and for these a permanent pasture including suitable leguminous plants seems to be the most economical method of soil improvement.

Most summer legumes are planted on land that is too poor to grow a cash crop. Although legumes are able to store their own nitrogen, they need other nutrients, especially lime, phosphorus, and potash. Naturally most of the fertilizer is applied to the cash crop, but excellent benefits may be obtained from a mixture of 200 to 300 pounds of basic slag and 40 to 50 pounds of muriate of potash per acre.

If summer legumes are to be planted on new soil, their seed should be inoculated with the proper culture in order to insure a successful crop.

Dollars-and-Cents Considerations of Legumes And Commercial Nitrogen

The most important thing to consider in any investment is value received for money expended. If value received is not more than the cost involved, then an investment is not profitable; and that investment is most profitable from which the greatest value is received. Money expended in buying legume seed and for inoculating and planting is an investment in building up the soil for greater crop yield. Likewise, money spent for commercial nitrogen is an investment in building up the soil for greater crop yield. In either instance, the value of the increased crop returns must overweigh the cost if the investment is a good one. Both legume nitrogen and commercial nitrogen have proven to be excellent investments, and it is necesary that nitrogen from one of these two sources be applied to our crops. The choice between them must rest upon other factors than increased yield, for it has been shown in preceding pages that a good crop of winter legumes and 24 pounds of commercial nitrogen are approximately equal for cotton production, and that a good crop of winter legumes and from 24 pounds to 32 pounds of commercial nitrogen are approximately equal for corn production. Three factors, however, are of high importance. They are (1) crop risk, (2) costs, and (3) effect upon the soil.

Throughout this bulletin, comparisons have been made on the basis of "a good crop of winter legumes". Experience has proven that not every planting of winter legume seed results in a good crop. Data compiled by the United States Department of Agriculture from a survey of 500 fields of winter legumes grown by 300 farmers in Alabama, Georgia, and South Carolina (Technical Bulletin 367, U. S. D. A., Washington, D. C.) show that approximately one-fourth the acreage planted in winter legumes resulted in crop failure. These records were compiled mostly for the growing seasons 1929-30 to 1932-33, and it seems likely that with increased knowledge of winter legumes production, crop failures have diminished during recent years. This factor, nevertheless, is still an important one and it is suggested by the author that the farmer consider his own experience and the experience of his neighbors in considering the percentage of crop failures in winter legume production he is likely to incur in the future.

Cost of Growing Winter Legumes

By compiling data from 500 fields the United States Department of Agriculture (Technical Bulletin 367, previously referred to) made a careful estimate of costs, but its estimate is probably higher than the actual cost obtained during the crop year 1938-39. It is summarized in the following table:

TABLE 14—EXTRA COST TO PRODUCE CORN AND COTTON AFTER WINTER LEGUMES

Item	For Corn Cash Cost	Non-cash Cost	Total Cost	For Cotton Cash Cost	'Non-cash Cost	Total Cost
Seed and inoculation	$2.96	$......	$2.96	$3.12	$......	$3.12
Man labor for planting	......	0.67	.67	......	0.60	.60
Horse labor for planting	......	.80	.80	......	.67	.67
Implement and machinery charge	......	.27	.27	......	.18	.18
Fertilizer	.81	......	.81	.50	......	.50
Extra work with plowing down legume	......	.25	.25	......	.30	.30
Total	$3.77	$1.99	$5.76	$3.62	$1.75	$5.37

The study included 4,145 acres of corn and 1,877 acres of cotton. Man labor was figured at 15c per hour. The cost for seed and inoculation—$2.96 per acre for corn and $3.12 per acre for cotton—is approximately $1.00 per acre more than present costs. It is suggested that the farmer may determine the exact cost of seed and inoculation at the present time by consulting the source from which he customarily buys winter legume seed.

The evaluated cost is probably higher than the average farmer estimates because in many instances he does not include the cost of labor or of implement charges. Nevertheless, these are legitimate costs and must enter into any accurate cost appraisal.

Cost of Commercial Nitrogen

The cost of commercial nitrogen varies somewhat from year to year, and here again the farmer may obtain exact costs by consulting sources from which he ordinarily makes his fertilizer purchases. 24 pounds of commercial nitrogen is obtained from 150 pounds of fertilizer material analyzing 16% nitrogen, and 32 pounds of commercial nitrogen is derived from 200 pounds of 16% nitrogen fertilizer. Various sources carry varying percentages of nitrogen, but the final price per pound of commercial nitrogen is fairly equal, regardless of source. The 16% nitrogen material sells for approximately $36 per ton. Therefore, 150 pounds of material supplying 24 pounds of nitrogen would cost approximately $2.70, and 200 pounds of material carrying 32 pounds of commercial nitrogen would cost approximately $3.60.

Home Grown Seed

Since the greatest single cost of winter legume production is for seed, the cost of a legume crop can probably be reduced to as little as $1.00 per acre if the legume seed can be grown. Numerous farmers in Mississippi and in other states are annually harvesting seed crops of winter legume seed. The Dairy Department of the Mississippi Agricultural Experiment Station has made it a long-time practice to produce its requirements of hairy vetch seed. Crimson clover seed is being satisfactorily produced in several areas of the state. Bur clover seed is widely produced in the delta and to a lesser extent in the hill section.

Not all winter legumes exert a similar influence upon the succeeding commercial crop. References to tables published throughout this bulletin will reveal the superiority of certain legumes under certain conditions. Nevertheless, every good crop of winter legumes, of whatever kind, has resulted in a substantial increase in the yield of the succeeding commercial crop, and if winter legumes can be secured without any out-of-pocket costs, an entirely different construction would be placed upon the subject here discussed.

Effect of Winter Legumes Upon the Soil

It is impossible to predict what effect turning under legumes will have upon our soils over a period of 20 to 30 years. Turning under legumes adds large amounts of organic matter which temporarily improves the soil; but the organic matter containing nitrogen is quickly decomposed and the heavy rainfall leaches and robs our soil of its nitrogen. A good crop of winter legumes may contain 75 pounds to 100 pounds or more of nitrogen when turned under, yet in the hill sections of Mississippi the succeeding commercial crop can utilize only from 24 to 32 pounds. Legumes feed heavily on calcium and the other bases of the soil, and the loss of nitrate nitrogen by leaching also depletes the soil of its bases which are essential to soil fertility and to maximum crop production. Therefore, these bases must be replaced by liming if the fertility of the soil is to be maintained under a long-term legume program. The harmful effect of turning under legumes without liming may not be noticeable in a brief period of time, but ultimately it will contribute materially toward reducing the lime supply and thus the fertility of our soils.

However, other experiments have shown the need of lime for such commercial production crops as cotton and corn, and to maintain the lime supply in the soil in conjunction with the winter legume program would add further benefits at minimum cost. If properly handled legumes will therefore be much more valuable to our soils than they have been thus far; but we must include liming with our legume program if we are to obtain maximum benefits from legume nitrogen.

Although the results indicate that commercial nitrogen can often be bought as cheaply as and sometimes more cheaply than legume nitrogen, agronomists of the Experiment Station feel that winter legumes have a definite place in our crop system. It is felt, however, that farming practices may be so improved that seeding costs may be minimized, adequate quantities of lime maintained, and better use may be made of the legume crop.

Improved Farm Practices in Conjunction With Winter Legumes

A good crop of winter legumes in the hill sections of Mississippi may weigh from 5,000 pounds to 12,000 pounds green weight per acre when turned under for soil improvement. The green weight depends upon a number of factors, the main factor in a given year being the kind of winter legume planted. Possibly, 8,000 pounds per acre green weight might be accepted as an average good crop. It has been shown that to produce such a crop costs approximately $3.50 per acre, including cost of seeding and other legitimate crop costs. Its value for soil improvement purposes, when measured in increased yields of succeeding crops, was approximately equal to that of 24 pounds of commercial nitrogen in the instance of cotton, and to 24 pounds to 32 pounds of commercial nitrogen in the instance of corn.

8,000 pounds of winter legumes (green weight) contain approximately 75 pounds of nitrogen. The experiments enumerated in this bulletin show, therefore, that only about one third of the nitrogen turned under is utilized by the succeeding commercial crop.

Much has been learned about winter legumes for soil improvement purposes during recent years; much remains to be learned.

Improved farm practices, with respect to fertilization and lime, and with respect to reducing out-of-pocket costs by seed production on the farm, were discussed in preceding paragraphs. Other improved practices may include a more efficient utilization of the winter legume crop.

Definite and pronounced progress has been made in Mississippi during recent years in the direction of more livestock on state farms. The basis of successful livestock production is generally accepted to be that of producing an adequate supply of foodstuffs for such livestock. It seems likely that winter legumes may be destined to occupy an important position in this respect, for grazing, for hay, and for silage production.

Experiments in the grazing of winter legumes have been conducted in Mississippi and a number of other cotton belt states, and have indicated that while some winter legumes are better than others for grazing purposes, all have a distinct value in late winter and early spring when customary pastures are normally inadequate.

The use of winter legumes for hay seems to present an attractive field of utilization. A good crop of winter legumes will yield a ton or more of choice hay at a time when normal supplies are low.

A relatively new development in agriculture is the utilization of a variety of forage crops, both legumes and nonlegumes, as grass silage. By means of this process immature grasses and clovers may be utilized as silage by the addition of a preservative such as molasses or food grade phosphoric acid. Such silage manufactured from winter legumes would permit removal of the winter legume crop in time for planting the succeeding commercial crop, would yield silage at the rate of approximately 3 tons per acre, and would provide silage to supplement short pastures during mid-summer when winter silage is customarily not available.

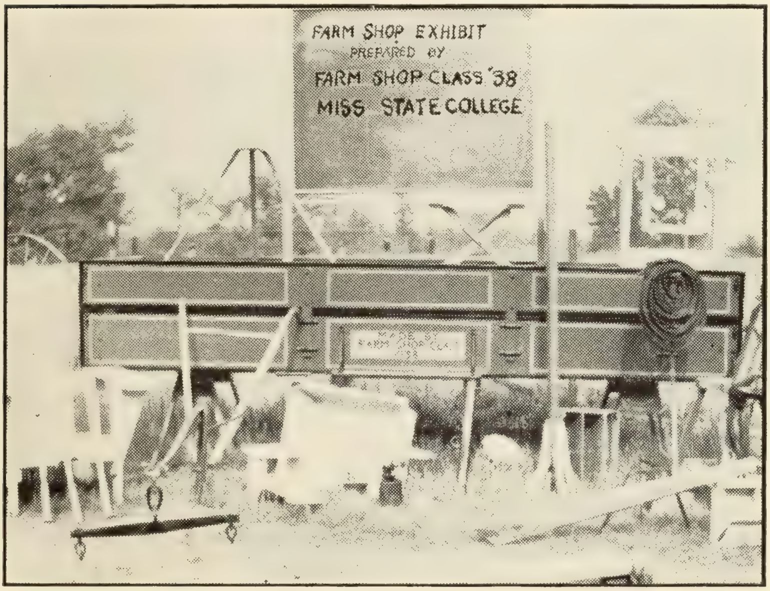
The utilization of legumes through livestock would therefore contribute materially to successful livestock production; it would contribute, also, to soil improvement to the extent that manures be conserved and returned to the crop land.

The ability to produce a crop of approximately 4 tons of winter legumes green weight at a cost of approximately $3.50 per acre, without in any way sacrificing the use of the commercial crop land, is undoubtedly a valuable natural resource of the lower south and worthy of further research.

Having determined the value of winter legumes when turned under for soil improvement purposes, it shall be the purpose of the Mississippi Agricultural Station to so extend its investigations as to include further studies on the production and utilization of winter legumes.

Bulletin No. 337 (Second Edition) May 1940

Farm Mechanics


FARM SHOP EXHIBIT
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INTRODUCTION

The farmer is not only a producer of agricultural products but he is because of necessity a farm mechanic. On every farm there is much farm shop work of a widely varying nature that can and must be done by the farmer.

Every farmer has the problem of keeping the farm machinery in working condition. A great many things must be made both for the house and farm. Many situations arise where the farmer will have to repair his farm buildings, and often the need arises for building small buildings, such as poultry houses, hog houses, etc. Harness has to be repaired. Milk cans, pails, and other vessels need to be soldered. Fences and gates need to be built and repaired. Painting and finishing jobs must be done about the farm house and farm buildings.

It is too often the case where neither the farmer nor his son have the skills and facilities necessary to do the kind of farm jobs enumerated above. As a result of this condition most of the farm shop work goes undone, or an expense is incurred by hiring it done.

What is the cause of this condition? Among other causes it is due to the lack of a place to work or a home farm shop. With a home farm shop available many cold and rainy days may be utilized profitably by repairing and making farm equipment and home conveniences.

It is recognized that the information presented in this bulletin does not cover completely the farm shop question. This is the first of a contemplated series of farm shop bulletins.

⁂

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LEATHER AND LEATHER WORK ON THE FARM

Leather is very important on the farm. Practically every farmer uses some leather harness. Many times when leather harness breaks it is temporarily fixed by tying together with hay baling wire, strings, and rope, and in many cases this becomes the only repair that is given, and often causes a loss of time. This condition exists due to the lack of leather and equipment on hand to make necessary repairs. The price of small quantities of leather is from 75c to $1.50 per pound which causes many farmers to repair their harness in the manner described above.

Most farmers at some time during the year have a cow hide that is thrown away, or sold at a very low price, that could be tanned at home and have the leather for making harness repairs. There are tanners that will tan leather for one half of the hide, or a certain price per pound. The name and address of these companies may be secured by writing the Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C.

Leather can be tanned on the farm. It isn't very agreeable work, but a person that is willing to spend the required amount of time can have a very good grade of leather. Without the proper care and attention during the tanning process there isn't any use trying to tan leather on the farm.

Home Tanning of Leather

Preliminary Operations: Before a hide is tanned there are certain preliminary operations that must be carried out which are the same for all methods of tanning given here. These operations are:

1. Put 6 to 8 pounds good quality burnt or caustic lime in a clean wooden container with capacity of at least 5 gallons. Never use air slacked lime. To the lime add 1 quart of water, gradually adding more water as the slackening process continues, but never add enough water to quench the slacking. After slacking stir in 2 gallons clean water. Slack lime on the day before soaking of the hide is begun.

Fresh hydrated lime, not air slacked, may be used 8 to 10 pounds in 4 to 5 gallons water instead of burnt or caustic lime.

2. Soaking and cleaning. If hide has been salted shake as much salt out as possible. Spread hide, hair side down, and trim off tail, head, ears, shank, and all ragged edges.

Spread hair side up on smooth log or board and split into two sides down the back bone line.

Soak in clean water with flesh side out for two or three hours. Remove and scrape all flesh off possible. Place hide hair side up and clean as thoroughly as possible.

Refill barrel with clean water and allow hide to soak from 12 to 48 hours, or until soft and pliable. After soaking clean hide thoroughly, removing all dirt, and flesh from the hide.

3. Pour slacked lime in barrel and fill nearly full with clean cool water, stir thoroughly. Hang hides on rope or stick, hair side out in lime water, being sure they are covered. Sides should be pulled up and lime water stirred 3 or 4 times daily, until hair will come off easily, usually requiring 6 to 10 days.

4. When limed, spread hides hair side up and with back side of drawer knife or butcher knife, push off hair from all parts. A curdy or cheesy layer of skin should rub off with the hair when properly limed. After this is done

soak the sides in lime water for another day or two and repeat the scraping process on the hair side of the hides to work out as much lime, grease and dirt as possible.

5. Turn sides over and "scud" or scrape, being sure to remove all fleshy matter and **being careful not to cut the sides.**

6. After unhairing and fleshing operations, rinse sides in clean cool water several times. Add 16 ounces of tannery 22% lactic acid in 40 to 50 gallons water and hang sides in it for 24 hours, pull sides up and stir frequently.

If lactic acid isn't available use 1 gallon vinegar instead. At this stage the sides are ready for tanning.

Tanning Oak Bark Formula

1. Pour 30 to 40 pounds ground oak bark into 20 gallons boiling water 15 or 20 days before tanning starts and allow to stand until using. Stir occasionally.

2. When ready to tan strain the tan liquor through a coarse clean sack into the tanning barrel. Finish filling barrel about ¾ full with water. Add 2 quarts vinegar. Place sides in tanning barrel with as few wrinkles and folds as possible.

3. Soak 30 to 40 pounds more oak bark in 20 gallons hot water. Let second bark liquor stand until sides are evenly colored or from 10 to 15 days. At this time take 5 gallons tanning liquor out of tanning barrel and add ¼ of the second bark liquor. Also add 2 quarts more vinegar and stir well. Every 5 days add ¼ of the second bark liquor until all is used.

4. At this stage weigh 40 pounds fine ground oak bark and moisten with hot water. Pull sides out of bark liquor and dump in the dampened bark. Mix thoroughly, and hang sides in the tanning barrel and leave for about 6 weeks. At this point the sides are ready for oiling and finishing.

Chrome-Tanned Leather

For hide weighing 30 pounds or more. For hides weighing less than 30 pounds use ½ of the chemical listed below.

1. Dissolve 3½ pounds crystallized sodium carbonate, and 6 pounds of common salt in 3 gallons warm, clean water in wooden or fibre bucket. At the same time dissolve 12 pounds chrome alum (chromium potassium sulphate crystals) in 9 gallons clean, cool water in wooden barrel.

When chemicals are dissolved pour soda salt solution slowly into the chrome alum solution, stirring constantly. Take at least 10 minutes to pour in soda solution. Keep solution well covered. This should be done two days before using.

2. Put 4 gallons of stock chrome solution in barrel and add 30 gallons of clean, cool water. Mix thoroughly and hang sides in barrel. Stir often the first few days.

3. After 3 days remove the sides temporarily and add ½ of remaining stock chrome solution and mix thoroughly and again hang in the sides, move the sides about and stir often.

4. At end of three days repeat the above operation.

5. After three or four days cut the sides to see if it is colored uniformly greenish or bluish throughout, if so the tanning process is about complete. Boil a small piece a few minutes. If it curls up and becomes hard or rubbery the tanning process is not completed and the sides must be left in tanning solution awhile longer. At this point the sides are ready for oiling and finishing.

Alum Tanning

1. Dissolve 12 pounds of ammonia alum or potash alum in 15 gallons clean water in wooden tanning barrel.

Dissolve 3 pounds crystallized sodium carbonate, and 6 pounds of salt in 5 gallons cold water in a wooden bucket.

2. Pour soda solution into alum solution in barrel very, very slowly, stiring the solution constantly. If soda solution is poured rapidly the solution will become milky and will not tan. Add enough cool water to nearly fill the barrel.

3. Hang sides in solution, pull up the sides and stir solution six or eight times a day.

4. After six or seven days remove sides from alum soda solution and rinse well for about a quarter of an hour in clean cold water.

Oiling and Finishing

With each method of tanning when sides are removed from tanning solution wash thoroughly in clean, cool water. Allow sides to drain and dry out slowly. While still very damp go over grain or hair side with liberal coating of neat's foot or cod oil. After oils have gone in and sides have dried a little more begin to work them over a "stake." When light spots or light streaks appear on folding it is time to begin staking.

Staking is done by pulling the damp leather vigorously back and forth over the edge of a small smooth board. The sides must be thoroughly staked all over in order to make them soft and pliable. The staking must be continued at frequent intervals until the leather is dry. When leather has been properly staked it will be soft and pliable.

When dry, evenly dampen the sides by dipping them in water or by leaving them over night covered with wet burlap or sacks. Apply to the grain or hair side a thick coating of warm dubbin. Dubbin is made by mixing equal parts of neat's foot oil and tallow or cod oil and tallow. Leave the greased sides in a warm place until dry. Scrape off the excess tallow and stake the sides. again. If leather is too hard dampen evenly with water before staking. It may be necessary to repeat this process several times to get a high quality leather.

After staking, go over the sides with a slicker, pressing the slicker firmly against the leather while pushing it away from the body. Slick out the grain or hair side in all directions.

The slicker can be made from a block of wood about six inches square, 1½ inches thick at the head, and shaved down in the shape of a wedge to a thin edge.

Reference: Farmer's Bulletin 1334, "Home Tanning of Leather and Small Fur Skins."

Leather Stitching Clamp

Materials Needed:

1. 1 piece pine 2″x12″x3′
2. 1 piece pine 1″x12″x1′-8″
3. 1 piece pine 1″x12″x3′
4. 2 pieces pine 2″x4″x3′-4″
5. 2 pieces pine 1″x2″x12″
6. 1 pair 3″ strap hinges

Directions:

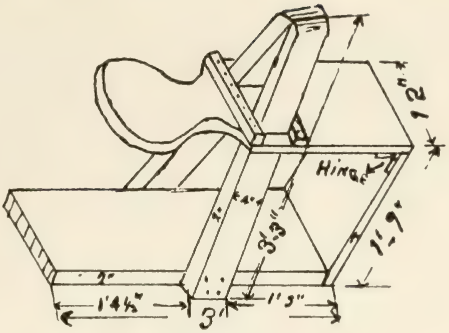


Figure 1

1. Cut bottom piece 3 feet long from 2″x12″ plank. Locate notches for jaws 1 foot, 3 inches and 1 foot, 7 inches from end. Cut notches for jaws at an angle so that they will come together at top.

2. Cut end piece 1 foot, 8 inches long from 1″x12″ lumber.

3. Cut seat 3 feet long from 1″x12″ lumber. Measure 1 foot, 3 inches from end as in bottom piece and cut notches in piece so that jaws may come through as illustrated in drawing. Hinge seat on to end piece with 3 inch strap hinges, cut two pieces 1″x2″x12″ for cleats to use on each side of jaws where they come through seat.

4. Cut jaws 2″x4″x3′ 4″. Shape as shown in illustration. The illustration shows the jaws fastened to bottom piece with screws. It would possibly be better to hinge jaws to bottom piece to allow the jaws to open freely when inserting leather.

Making a Bridle

Materials Needed:

1. 2 ½″ buckles for throat strap
2. 4 1¼″ buckles for cheek straps
3. 1 pair bits
4. Gauge knife
5. Rivets and rivet set (all rivets should be put in with the smooth side to the animal)
6. Awl, thread, harness needles, and harness wax

Directions:

Throat Strap—Cut a strap 20½ inches long and ½ inch wide. Put on each end a ½ inch buckle. The finished throat strap should be 18½ inches long.

Head Strap—Cut a strap 24 inches long and 1¾ inches wide. Then cut each end back for a distance of 7¼ inches and ½ inch wide to fit into the throat strap. Be sure that this strip is cut on the same side of the 1¾ inch strap. Punch six holes in each end.

Brow Band—Cut a strap 22 inches long and ¾ inch wide. Bevel the ends slightly on the flesh side. Then fold back each end for 2¼ inches and rivet or sew to make a loop to fit the head strap. This gives a strap with 2 loops and length of 17 inches. If blinds are to be put on the bridle, the brow band is not absolutely necessary, though a better bridle will be made if it is put on. Likewise, a rivet placed in the loop so as to pass between the ½ inch strip and the 1¼ inch strip will make it stiffer and it will look better. This rivet can be covered with a piece of leather or a brass "spot."

Cheek Straps—Bit Straps—Cut two straps 12 inches long and 1¼ inches wide for cheek straps. Cut two straps 13 inches long and 1¼ inches wide for the bit straps. Bevel one end of the bit straps slightly on the flesh side.

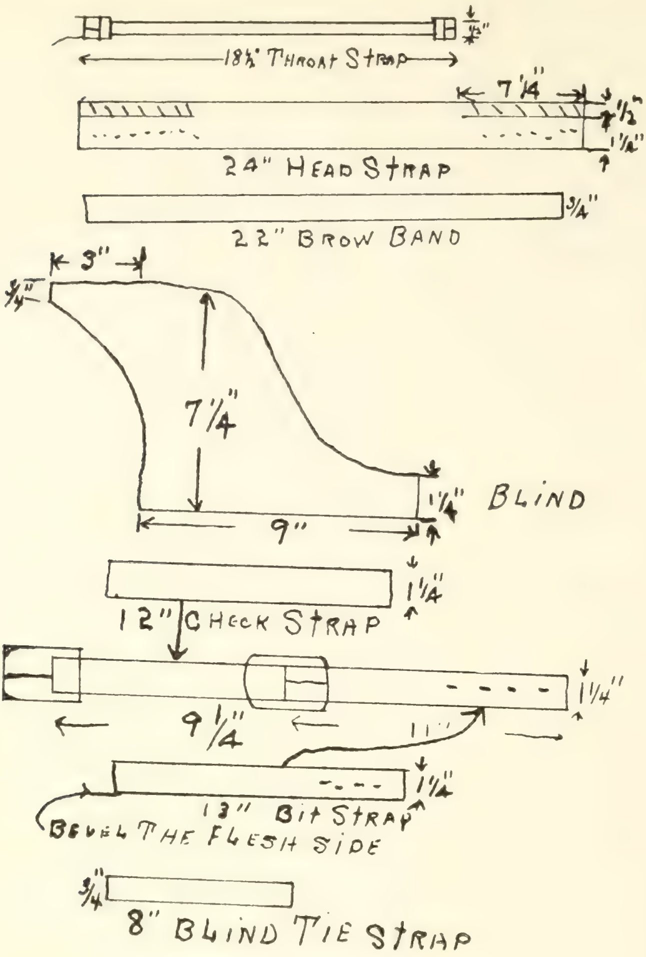

18½" Throat Strap
½"
7¼"
½"
1¼"
24" Head Strap
¾"
22" Brow Band
3"
¾"
7¼"
1¼"
Blind
9"
1¼"
12" Check Strap
9¼"
11"
1¼"
1¼"
13" Bit Strap
Bevel the flesh side
¾"
8" Blind Tie Strap

Figure 2

Punch six holes 1 inch apart on other end. Fold these ends of the cheek straps back 1½ inches and fit a 1¼ inch buckle to each end. At one end of each cheek strap rivet the bit strap behind the cheek strap with the flesh side out. The lap of the bit strap on the back of the buckle on the cheek strap should be 2 inches. Fit the bits in and assemble.

Blinds—In case blinds are put on the bridle, cut two pieces like the sketch and turn them over and cut two reverse pieces. Sew two pieces together with flesh side together. Then sew to upper end one strap 8 inches long and ¾ inch wide. Then sew the cheek straps and bit straps to the blinds with buckles sewed in. The cheek straps lap for the buckle and the bit straps should be sewed back of the blinds. The 8 inch strap at the top is pulled to the center of the head strap and the blinds shaped. Then the 8 inch strap is riveted and the extra leather cut off.

Reference: Texas Extension Service Mimeograph MS-260, "Making a Bridle," College Station, Texas.

Repairing and Caring for Leather Harness

"A stitch in time will save nine" is a time-honored axiom that might well be applied here. A little repair work at the proper time will add many more useful years to leather harness.

Directions:

Repairing a Leather Bridle—Examine bridle to determine if piece or pieces are broken or ripped apart. If the pieces are ripped, remove all old thread and hardened accumulations. Sew pieces back together by sewing through old stitch holes.

When pieces are broken, rip off all broken parts. It is sometimes necessary to use wire pliers in removing sprigs and brads. All pieces that are to be put back into the bridle should be thoroughly cleaned of all hardened accumulations. Buckles should be saved from broken parts.

Cut pieces of repair leather the same size as those broken. This can best be done by measuring similar pieces on an unbroken bridle or the other half of the same bridle.

If there are ends to be beveled, do all beveling from flesh side of the leather. This will leave the strongest part of the leather to be used. When bending to sew on buckle or snap always bend to flesh side.

When pieces that are to be sewed are placed in position, they may be held secure by driving short wire sprigs through them. If the pieces can be riveted together, rivet and then sew. The sprigs may be bradded and left in the leather.

When all riveting and stitching has been completed, wash old leather parts with a rag saturated with gasoline. Allow to dry a few minutes and rub all leather parts thoroughly with a rag dipped in a harness oil. If the old strap pieces seem hard and stiff, pull briskly across the edge of a 1" plank and re-oil.

Repairing Leather Lines—Examine to determine what parts to remove.

Remove all wire, knots, etc., in lines, and cut out all parts of the line that are badly worn or broken.

Determine how much new leather will have to be added to each part to bring the lines back to standard length. (The outside rein or short line is usually 5′ to 6′. The inside rein or long line is usually 6′ to 7′, and the remainder of the line is 8′ to 10′, depending upon the length desired.)

Do all beveling from flesh side. Bevel enough for a 3″ lap at each joint. Bevel so that the joint will be only slightly thicker than the other part of the lines, place two rivets at each joint and stitch. The rivets should be placed so as to brad on the flesh side.

Wash old parts with a rag saturated with gasoline. Allow to dry a few minutes and thoroughly oil entire line.

Repairing Leather Collar—Anyone or all of the following may need fixing about a leather collar. The top strap or buckle may be off. The neck protection piece may be off. A small or large hole in side, thus causing loss of packing. The collar might be broken at bottom, causing it to be mean in putting on mule or horse.

If the top strap buckle and neck protection piece needs replacing, cut all pieces to fit, punch holes through all pieces at places desired and fasten on with copper rivets and burrs. The burr should be bradded on from the top.

If collar needs packing use fine oat straw or fine hay. Lace with raw hide ¼″ wide. A collar awl will make this lacing much easier.

If a piece of leather is to be placed around the collar to strengthen it or stop up a hole, get a pliable piece of thin leather and shape to fit collar. Trim all edges rounding. Soak the piece in water for a few minutes, remove and hammer thoroughly to make the leather easy to stretch. Pull around collar tightly and sew. As the piece dries it shrinks and becomes tighter.

Cleaning and Oiling Leather Harness—To add years to the life of leather harness, it must be kept clean and oiled. The following are two methods of cleaning and oiling leather.

1. Soap and Water.

Materials Needed: About ½ tub warm water, a piece of common soap, a brush with stiff fibers, harness oil and a 1"x10"x5' board with strips nailed along edge to prevent water from flowing off the plank.

Directions: Place one end of scrub plank over edge of the tub and place the other end on saw horse or some other object that will give it an incline of about 30°.

Dip pieces of harness in warm soapy water, place on scrub plank and scrub with brush, more soap may be added to brush if desired. When all dirt and hardened accumulations have been removed, wipe excessive water and soap off and hang up to dry.

Oil the leather thoroughly when about two-thirds dry. In case of strap pieces, pull over the edge of 1" plank until limber and re-oil.

NOTE: Harness can be oiled by dipping in a vessel of water with about 1" of oil on top. Dip the harness in the solution two or three times. Hang up to dry. Wipe all excessive oil off before using. Skim oil off of water and save.

2. Gasoline and Rag.

Materials Needed: Gasoline, rag, putty knife, and harness oil.

Directions: Take putty knife and scrape off all hardened accumulation.

Dip the rag in gasoline and rub leather briskly until all dirt is removed. Allow to dry a few minutes.

Saturate a rag with harness oil and rub on leather until leather is thoroughly oiled. If strap pieces of leather are stiff, pull across edge of 1" plank until limber and re-oil.

PAINTING AND WOOD FINISHING

"Painting is an art and there are many things about the art of painting which require study, observation, and constant practice."

The one thing to keep in mind when selecting a paint is that it always pays to use a good grade. A good grade of commercial mixed paint will cost only slightly more than a cheap grade, but it will pay in the long run. Many painters practice mixing their own paint which will always insure a good grade of paint if the proper ingredients are used and the mixing is thorough.

White Lead Paint. White-lead might be called a very concentrated paint itself. It comes in two forms, soft paste and heavy paste. To the white lead must be added linseed oil, turpentine, and drier, in order to make a usable paint out of it.

Mixing Paint for Small Paint Jobs. Many paint jobs around the farm require only a small amount of paint. The white-lead can be bought in 10 to 50 pound cans and used as needed. A glossy finish is often desired on all interior woodwork. Equal parts of white-lead mixed with equal parts of linseed oil (all parts by volume) will give such a finish. Determine approximate amount of paint needed. Measure out the white-lead and thoroughly stir in the needed amount of oil, a little at a time. If heavy paste is used stir in about ½ pint of turpentine and ¼ pint of drier for each gallon of paint. Then pour from one container to the other four or five times. This will thoroughly mix the paint. The above proportions will give a rather thick or heavy paint which is desirable for a gloss finish. However, if a thinner paint is needed, add more linseed oil and turpentine. For the priming coat, the quantity of paint should be increased by ½ by adding 1 part linseed oil and 2 parts of turpentine.

Mixing Large Quantities of Paint. There is nothing difficult about mixing white-lead paint in large batches. First, place as much white lead as needed for the job in a mixing can a third larger than the quantity of paint needed. If soft paste is used, stir in the free oil on top before pouring. Next, reduce the paint by stirring in the oil, turpentine and drier. If boiled linseed oil is used, omit the drier. Best results can be obtained in mixing by thoroughly stirring in a small amount of oil at a time. When all oil has been stirred in, add the turpentine and drier and pour from one container to another four or five times and strain to remove all lumps. Stir the paint frequently while using. When not using cover tightly.

Formulas for Mixing Paint for New Outside Wood

1. For the Priming Coat

White lead	100 pounds
Raw linseed oil	4 gallons
Turpentine	2 gallons
Drier (omit if boiled oil is used)	1 pint

This formula will make about 9 gallons of paint, and each gallon will cover approximately 500 square feet of surface.

2. For the Second Coat

White lead	100 pounds
Raw linseed oil	1½ gallons
Turpentine	1½ gallons
Drier (omit if boiled oil is used)	1 pint

This formula will make about 6 gallons of paint and each gallon will cover approximately 600 square feet of surface.

3. For the Finishing Coat

White lead	100 pounds
Raw linseed oil	3 gallons
Drier (omit if boiled oil is used)	1 pint

This formula will make about 6 gallons of paint and each gallon will cover about 600 square feet of surface.

If only two coats are to be used omit formula 2, when repainting outside wood that has been previously painted, omit formula 1.

The above formulas may be adjusted to meet the particular condition of the surface which is to be painted. It is suggested that the advice of an experienced painter be secured before making any adjustment in formulas.

Calculating Quantity of Paint Needed for House

The following method of calculating will give only approximate gallons needed. Measure the total distance around the house in feet and multiply by the number of feet to the eaves. Next multiply the widest part of the gables in feet by one-half their height in feet. Add these figures to get the total number of square feet and then divide by the number of square feet that one gallon of paint will cover. This will give the approximate number of gallons needed for one coat. Multiply this number by the number of coats desired and you have the gallons of paint needed for the job.

For the average width trim, figure about one gallon of paint for each 300 to 350 lineal feet.

Suggestions on Applying House Paint

1. Before the paint is applied the surface should be thoroughly cleaned and dry. The knots should be covered with a coat of aluminum paint, and nail holes, bad joints and cracks filled with putty. If aluminum paint cannot be secured, shellac may be used to cover knots.
2. Begin at highest point on building and work down. Paint across building with the grain and continue until bottom is reached.
3. Brush out well so that the laps will not show.
4. Dip slightly less than half of the brush into the paint and pull out over the edge of the bucket.
5. Use a good quality brush about 4″ wide.
6. Never put more than 3 quarts of paint in the paint bucket at a time and stir frequently with a paddle.
7. Allow first coat to thoroughly dry before applying the second coat. Apply second coat in same manner as first coat.
8. If a third coat is to be applied allow second coat to thoroughly dry before applying it. Apply in same manner as first and second coat. For density of paint for the different coats see formulas. Allow at least 24 hours between coats and if time permits three or four days between coats will be better.

Using Commercial Mixed Paint

Since the different brands of paint require varying amounts of oil and turpentine, it is suggested that directions on can for adding oil and turpentine be followed.

References: The Handbook on Painting—National Lead Company
Farmer's Shop Book by Roehl
Bruce Publishing Company
Farm Enterprise Mechanics by Davis Lippincott

General Directions for Preparing Whitewash

In compounding the following formula either quicklime or hydrated lime may be used for the preparation of the lime paste. For best results the manufacturer's directions should be followed in making this paste by slaking quicklime or by soaking hydrated lime. Approximately 8 gallons of stiff lime paste are produced by slaking 25 pounds of quicklime with 10 gallons of water, or by soaking 50 pounds of hydrated lime in 6 gallons of water.

To remove small lumps of foreign matter which may be present, it is recommended that the paste be strained through a fine screen. This is especially important when the whitewash is to be applied with a spray pump or paint gun on plaster or other smooth interior surfaces.

Whitewash Formula

Salt	12 pounds
Alum (powdered)	6 ounces
Molasses	1 quart
Lime paste	8 gallons

Dissolve the salt and alum in 4 gallons of hot water and then add the molasses. Add the clear solution to the lime paste, stirring vigorously, and then thin to the desired consistency. This formula produces a whitewash that has a yellow tinge when first applied. However, this color disappears within a few days, and a very white and durable coating results.

Reference: National Lime Association Bulletin No. 304D, "Whitewash and Cold Water Paints," pages 4 and 5, Washington, D. C.

A Cheap Varnish

2½ pints of turpentine
3 pounds dried resin
5 quarts boiled linseed oil (commercially boiled)

Stir the resin into the turpentine and shake well immediately, allow to stand for about two days, shaking the solution occasionally during this time. At the end of the second day add the five quarts of boiled linseed oil and shake thoroughly. Allow the mixture to stand in a warm room until the upper portion of the mixture is clear; then pour off the upper or clear portion which is the material used as varnish. It is now ready to use.

A Cheap Varnish Stain

"Here is a formula that I believe dozens of farmers will welcome as I did, as it gives us a chance to beautify our homes at so little cost. It is a varnish stain that can be used on doors, unpainted furniture, chairs, or anything where a hardwood finish is desired, and costs about 30 cents a gallon. Take five pounds of non-asbestos roof patching cement (not coal tar) that costs about 5 cents a pound and mix with two gallons of clear gasoline. Apply as you would any other stain. The results are marvelous and the cost is so little."

—Robert W. Griffin.

A Home-Made Stain Formula

1 pound burnt umber
1-1/5 quarts turpentine
11 ounces linseed oil
8 ounces Japan drier

The above proportion mixed according to liquid measure will produce a dark oil stain somewhat resembling walnut. Burnt umber should be ground or stirred into the linseed oil before drier and turpentine are added. This stain serves well for staining projects made of cheap or rough lumber. Since this stain will hide the grain on the fine finished material, it should not be used on material where it is desired that the grain show.

—From the Home Craftsman, Sept.-Oct., 1938.

Home-Made Red Stain for Farm Use

This stain is made by mixing metallic oxide, used or burnt motor oil and Japan dryer.

To mix, proceed as follows: Place about 3 pounds of metallic oxide in a two gallon container and pour in one gallon of burnt motor oil (if oil is too heavy thin with gasoline). Add ½ to 1 pint of Japan dryer. Stir the solution until it is well mixed. After stirring thoroughly pour from one container to another four or five times. This stain is satisfactory for staining all farm out buildings and farm implements.

Home-Made Black Stain for Farm Use

This stain is made by mixing lamp black, used or burnt motor oil and Japan dryer.

To mix, proceed as follows: Place 2 pounds of lamp black in a two gallon container and pour in one gallon of burnt motor oil thinned to about a 20 to 30 wt. If the oil is too heavy drying is not satisfactory. Add ½ to 1 pint of Japan dryer. Stir the solution until it is thoroughly mixed. Mixing can be increased by pouring from one container to the other several times. This stain will suit for any kind of implement staining, but drys rather slowly on iron.

Formula for Screen Paint and Auto Top Dressing

1. Melt one gray or black inner tube—use iron dinner pot or other convenient receptacle.

2. When it starts to congeal, remove from fire and work it up thin with turpentine.

3. Pour one can (10c can) of black enamel therein and stir well.

NOTE: Paint screen in ordinary way, being sure that mesh or openings in wire are not closed by the paint, paint both sides of screen.

As a top dressing, spread on thin.

A Home-Made Wax and Polisher

This wax is made by mixing beeswax, paraffin wax, linseed oil, and turpentine. The striking things about this wax are its quality and its inexpensiveness.

To mix, proceed as follows: Place ½ pound of beeswax and one pound of paraffin wax in an iron container and melt slowly. Melting can be speeded up by chopping the wax into small pieces. When all wax has melted, remove from fire and add ½ pint of raw linseed oil and 1¼ pints of turpentine. Stir the solution well and store in light containers. The above proportions will make approximately ½ gallon of wax. Do not work in a room where there is open flame when adding turpentine.

This wax has been used successfully for years by homemakers who take pride in making their floors attractive. "Waxing and polishing decreases upkeep and repair bills." The life of all type composition rugs or coverings can be increased by coating with this economical wax.

The success in using this wax lies in the method of application. Clean all surface to be waxed. Apply small amount to floor or surface with soft cloth or rag, allow to stand a short time and then rub into the surface and polish until there is no free wax on the surface.

Reference: Mothers' Home Life and Household Guest, December, 1935.

Wood Finishing

One of the most important elements in wood finishing is the preparation of the surface. After the article has been constructed, the steps in finishing are as follows:

The first step is to plane, scrape, sand and polish to a smooth clean surface. The surface should be free of irregularity, with all grease and oil spots removed. After the sanding has been completed, use very fine steel wool for polishing. Do all sanding and polishing with the grain of the wood. Brush all grit and dust from the surface.

The second step is to stain the wood, if a dark color is desired. The purpose of staining is to change the color of the wood to suit the taste of the individual. There are four kinds of stains: Oil stain, spirit stain, water stain, and aniline stain. For the person inexperienced in wood finishing, oil stain is recommended. If the stain is too dark, it may be lightened by adding a small quantity of oil and turpentine. The stain is applied with a brush. The brush should be pulled with speed with the grain. This tends to prevent some spots showing darker than others and the showing of brush laps. It is a good practice to wipe up the surplus stain by rubbing briskly with a piece of cloth. This helps to blend the stained surface. A higher polished finish may be obtained by an extra amount of rubbing.

The third step is to apply the filling. The purpose of the filling is to fill the pores of the wood and give a level surface. Paste wood filler is very satisfactory for the purpose. The filler should be the same color as the stain applied. The filler can be applied with an old brush or a cloth and rubbed into the pores, rubbing should be done across the grain. Allow at least 24 hours for the filler to dry before proceeding to the next step. The following woods do not require filler: beech, gum, pine, cedar, and sycamore. Those generally requiring a filler are: walnut, poplar, cherry, and oak.

The fourth step is the application of a thin coat of white shellac. The purpose of the shellac is to thoroughly close the pores of the wood. The shellac leaves a surface which prevents the varnish from sinking into the wood. When varnish sinks into the wood, blemishes occur on the finish. After the shellac has become thoroughly dry, rub the surface lightly with fine steel wool. This produces a perfectly smooth surface for the varnish.

The fifth step is the application of the varnish. Take enough varnish on the brush to flow well and not pull or drag when applying. About 20 minutes is required for varnish to set, therefore, the runs and sags can be easily touched up. A good rule in varnishing is to "put the lightest and thinnest coat possible." Three thin coats produces a better finish than two heavy coats. Best results can be obtained by taking long, steady strokes. When air bubbles occur the following things could cause them: Too much thinner, too much bending of brush across its bristles, or shaking can too vigorously. Always allow the first coat of varnish to thoroughly dry and rub lightly with very fine steel wool before applying the second. To secure the best finish, apply two or three thin coats of varnish, wax and then polish.

The Care of Paint and Varnish Brushes

One of the essentials of good painting is a good brush. To keep a good brush good it must have good care.

When a paint brush is in daily use, it may be kept soft and fresh by wrapping in a heavy paper overnight. In the case of shellac brushes, it is necessary to wash or suspend them immediately in alcohol, since shellac dries and hardens very rapidly. Varnish brushes can be cleaned with turpentine, but turpentine will not clean a brush that has been used to apply shellac.

A paint brush which is not to be used for a short interval such as a week or two can be kept soft by suspending the bristles in kerosene. Water is sometimes used instead of kerosene. If a varnish brush is to be used frequently, the bristles should be suspended in turpentine or oil. The shellac brush should be suspended in alcohol. The bristles should be wrapped tightly in brown paper. This will prevent the bristles from bending and becoming separated.

When a brush, regardless of use, is not to be used for some time, it should be cleaned in the proper solution, i.e., paint and varnish brushes with kerosene or turpentine; shellac brushes with wood or denatured alcohol then washed with soap and warm water. Rinse all soap out and "sling" as much of the water as possible out of the brush. Wrap in a clean piece of paper and store in dry place.

IMPORTANT—An expensive paint brush should always be washed, wrapped in paper and stored in oil. All types of brushes may be stored in oil as a safety precaution.

FARM ELECTRICITY

With the existence of T. V. A., R. E. A., and other agencies for extending electricity into the rural section of Mississippi, it is very important that the farmer should have some idea of the basic principles of house wiring for electrical appliances, so that he may protect himself if the wiring job is contracted, or do the job correctly if he does it himself.

To one who has never attempted to wire a house it may seem a very difficult and complicated task. It is a comparatively easy job and not too complicated, but you must not undertake the work without really studying the subject. You cannot learn to do good wiring in 15 minutes, by causally skimming through a few printed pages of instructions. Really learn how to do it right, or hire a contractor who knows how.

A house should be wired with definite considerations in mind:

1. It must be wired to give adequate service lights wherever you want them and switches to control them.

2. It must be neatly wired.

3. It must be correctly wired to meet all requirements of National Electric Code. This is a safety measure. Use only underwriter's approved materials.

4. It must be wired with future needs in mind. Every person will add electric equipment that was not originally planned, and spending a few extra dollars when wiring will save a lot of extra expense later.

Kind and Size of Wire

Wire comes in various sizes: The smaller the number the heavier the wire. The more electricity that is forced over a wire the larger the wire required to prevent heating. In ordinary house wire for 115 and 230 volts, No. 14 wire is used. However, with the constant addition of lamps and different appliances it is much better to use No. 12 wire. The smaller wire seems to cause "voltagedrop" which causes a dimmer light than should be gotten. There is only a slight difference in cost between No. 12 and 14 wire. See figure 3.

For 32 volt work, No. 12 wire is the smallest that can be used and No. 10 wire is required on any circuit with outlets where two or more appliances may be connected.

Bare copper wire cannot be used because a short circuit will occur where-ever two wires touch each other and might cause serious damage. Where wires are used out-of-doors, exposed to the weather, "weather proof" wire is

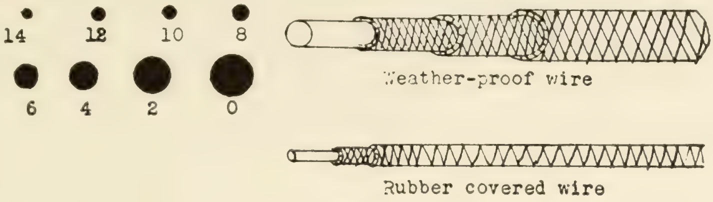


Figure 3

used which has three cotton braids saturated with weather proof insulating compound, as illustrated in figure 3. Wires used inside are rubber insulated, covered by saturated cotton braid.

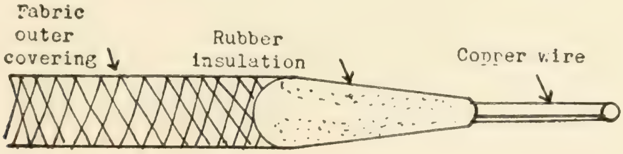
Joints and Splices

In wiring it is always necessary to join two or more wires. It is important that these joints be made properly or trouble will be encountered. There are 5 steps in making a joint.

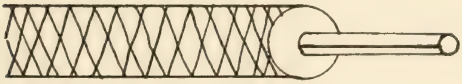
1. Removing insulation and cleaning wire
2. Twisting wire together
3. Soldering
4. Covering wire with rubber tape
5. Covering wire with friction tape

Removing Insulation

In removing insulation, the outer fabric is removed for half an inch further than insulation. The rubber should be removed with knife held at a slant as in sharpening a pencil. Never hold knife at right angle to the wire, because this will cause a nick in the wire which will cause the wire to break when bent or twisted. See figure 4.



RIGHT METHOD



WRONG METHOD

Figure 4

Scrape ends of wire to be joined clean and bright, otherwise a good soldering job cannot be done.

Splices and Joints

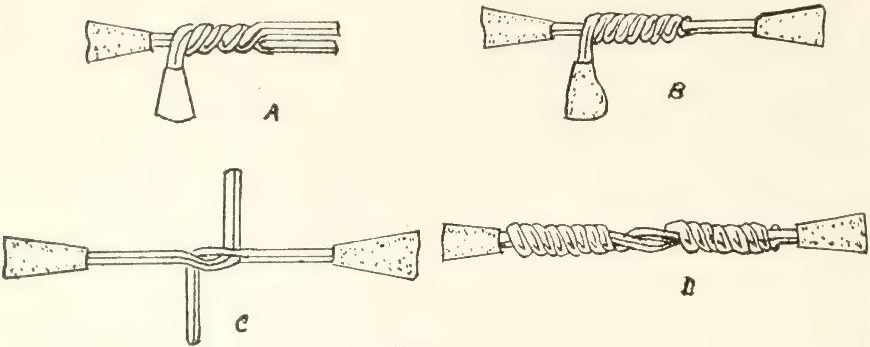


Figure 5

In joining two wires where there is no strain, join as in figure 5a above.

Figure 5b illustrates joining a wire to a continuous wire.

Figures 5c and 5d illustrate a joint in a wire that will have considerable strain, as for example wire stretched between buildings.

Soldering

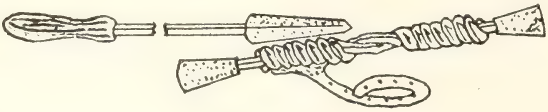


Figure 6

To do a good job of soldering, the soldering copper must be clean. A flux must be used. Do not use acid flux or acid core solder. Resin core solder is very handy. The soldering copper or blow torch should be applied to the wire until it is hot enough to melt the solder when applied to the wire. Care must be exercised to prevent the flame from burning the insulation. In this way the solder will flow into all open spaces in the joint, giving a tight connection.

Applying Tape

In taping a soldered joint, first apply rubber tape. Start winding the tape on the rubber insulation diagonally around the wire, keep it stretched as applied. Apply the second layer diagonally in opposite direction to first layer, be sure that as much rubber is applied as was on the wire before insulation was removed.

Apply a layer of friction tape over the rubber tape to take the place of the fabric covering on the wire.

In fastening wires in a switch or any other place where wires are held by screw, be sure that the loop of the wire is put under the screw so that when the screw is turned the loop tends to close rather than to open. See figure 7.

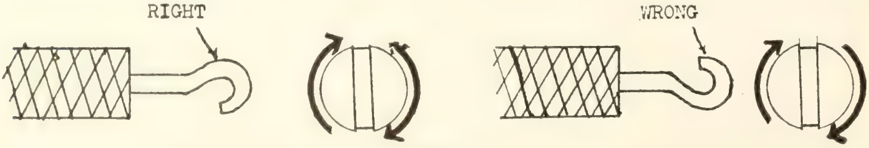


Figure 7

Fuses

What is a fuse? It is nothing more than a safety valve to protect electrical wiring in case of overloads. Without the fuse an overload or damaged appliance might cause a short circuit, which might result in a fire. A fuse is merely a piece of accurately sized wire of a special low melting point material, placed in a gap in the house wiring which melts and shuts off the current in case a wire is called on to carry more current than is safe.

Fuse sizes must be chosen to match the size wire they are called upon to protect.

To protect No. 14 wire, use fuse not over 15 amp.
To protect No. 12 wire, use fuse not over 20 amp.
To protect No. 10 wire, use fuse not over 25 amp.
To protect No. 8 wire, use fuse not over 35 amp.
To protect No. 6 wire, use fuse not over 50 amp.
To protect No. 4 wire, use fuse not over 70 amp.

Systems of Wiring

1. Knob and tube
2. Armored cable
3. Non-metallic sheathed cable
4. Rigid conduit

The knob and tube system of wiring costs a great deal less than the other systems of wiring and for farm use will give as good service.

There is definite information that a person must have before wiring with this system. In wiring most farm houses the wiring must be done in a finished house. This makes the wiring rather difficult. All wire possible should be concealed in the attic, but it will be necessary for some of the wire to be exposed, which detracts from the appearance of the wiring job.

The so-called "single braid rubber wire" is used with this system. Joints are permitted where needed provided they are properly soldered and taped. Use one black and one white wire. No. 14 wires are permitted, but better services at very little added cost will be gotten from No. 12 wire.

The wire must be stretched tight to prevent touching the wall surface. If wires are exposed they must be 2½ inches apart and at least ½ inch from surface; if concealed they must be 3 inches apart and 1 inch from the surface over which they run. If wires come closer together or closer to surface than specified above they must be covered with a continuous piece of loom (a loom is a fabric covering for wires) extending to the last porcelain knob cleat or tube at each end. If wires end at socket, box or other device the last knob or cleat must not be over 12 inches away. See figures 8 and 9.

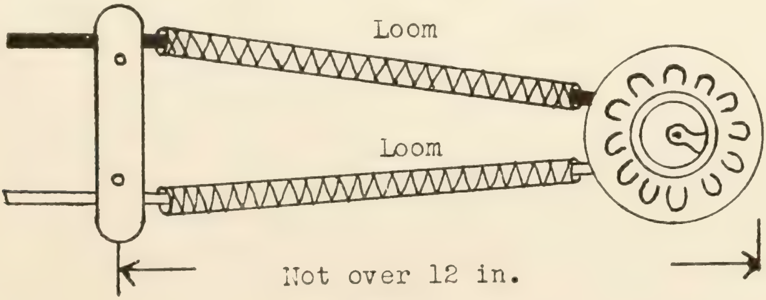


Figure 8

Porcelain tubes must be used where wire goes through any wooden joist, stud, floor, etc. In using porcelain tubes the hole should be put through the timber at an angle to keep tube from slipping out.

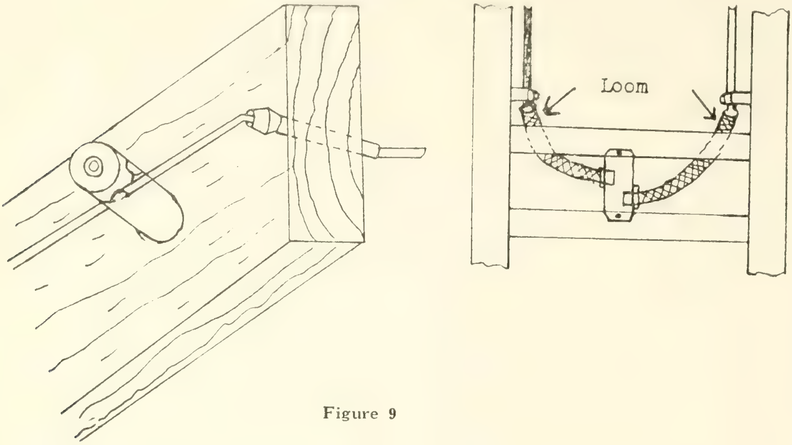


Figure 9

On straight runs, knobs and cleats must be over 4½ feet apart.

When tapping wires a cleat or knob must be within 6 inches of the tap. When crossing wires a porcelain tube must be used or the wires will be too close. A knob or cleat should be placed close to the end of the porcelain tube to prevent slipping and permitting two wires to touch.

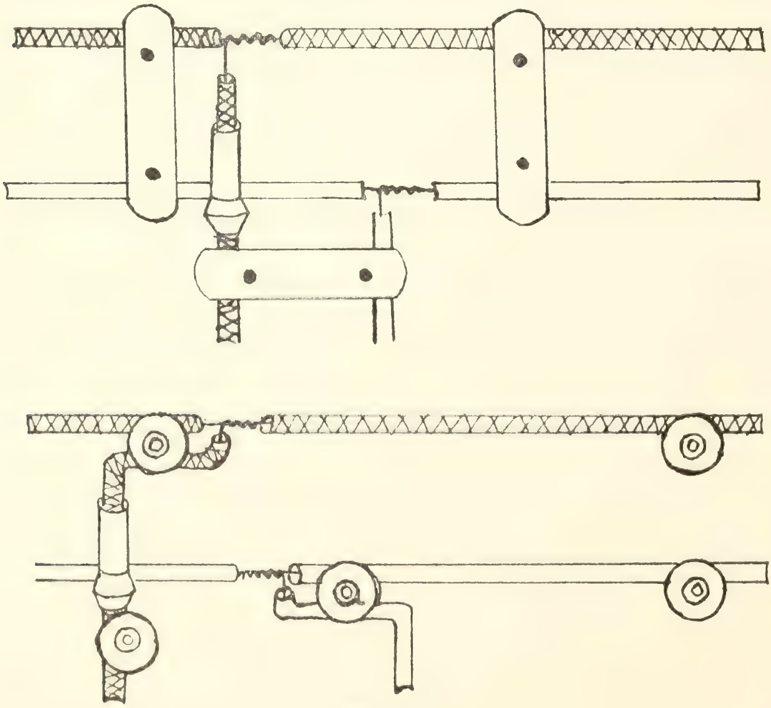


Figure 10

When connecting wires to socket the white wire connects to the screw shell of the socket and the black to terminal which connects to the center contact in socket.

Before wiring it is necessary to determine the number circuits needed. A circuit is a group of lights protected by one fuse. All lights in a house should never be wired on one circuit, because in most cases an overload would result and the fuse burned out. By having two or more circuits the house would not be in darkness if one set of fuses were burned out. In using electrical appliances as electric range, water heater, etc., a separate circuit must be installed for each appliance. The appliance must be wired on 220 volts where the ordinary lighting circuits are only 110 volts.

When wiring be very careful to see that all outlet boxes are securely fastened, using loom from box to knobs or cleats. See that all joints are properly soldered and taped. Stretch wire tight and use plenty knobs or cleats, and no trouble will be encountered in installing an electrical wiring system.

Anyone wishing more details as to how house wiring should be done it is suggested that you order "Wiring Simplified," Eleventh Edition from Montgomery Ward, Chicago, Illinois.

Reference: "Wiring Simplified," Eleventh Edition, Montgomery Ward, Chicago, Illinois.

Care of Electric Motors

Use oil only in the bearing and then very sparingly as most motors are oiled too much. Never oil any part other than the bearings.

If the motor has a commutator and brushes, occasionally, while the motor is running, hold a piece of very fine sandpaper, never emery cloth, against the commutator to remove the carbon that has worn off the brushes.

FARM BLACKSMITHING

Farm blacksmithing is possibly the most important phase of farm shop work. It has been observed that the need for skills in farm blacksmithing is greater today than it was a score of years ago. The village blacksmiths make themselves conspicious by their absence. A score of years ago in practically every village there was a blacksmith shop. This is not true today. In most communities throughout the South the farmer has to do his own blacksmithing or it goes undone, and the latter is generally true.

The absence of the home farm blacksmith shop during the present generation has created a situation with the young farmer that makes training in the development of farm blacksmithing skills an imperative part of the farm shop training program in the rural high schools. It is recognized that the average farmer has neither the time nor training to become a skilled blacksmith, but there are many simple jobs that are easily learned and will save many expensive delays in carrying on the farming operation.

Building and Maintaining a Forge Fire

The first and most essential thing to do in blacksmithing is to learn to properly build and maintain a forge fire. No matter how skilled one may be he cannot do his best unless he has the right kind of fire in the forge.

Materials Needed:

Blacksmith coal (a soft crumbly coal)
Shavings or wood chips and water

Directions:

1. If the forge has been previously used, clean out the "duck's nest" or fire bowl.

2. Select a pile of coke free of metal clinkers, crush the larger lumps.

3. Place a handful of shavings or chips in the bottom of the fire bowl. Light and give a little draft. Cover quickly with the selected pile of coke.

4. Let this burn well and then press it to the center and add water wetted blacksmith coal all around it. Wetted blacksmith coal is commonly referred to as "green coal."

5. If there is no coke available, cover the lighted shavings with unwetted blacksmith coal. Give a good blast until the coal is burning well, then cover the fire with green coal. Rake the coal over the fire to keep the flame from coming through.

6. As the coal changes to coke push it to the center and add more green coal around the edge of the fire bowl until a mound of coal banked about 5 inches high is around the fire. (See illustration below).

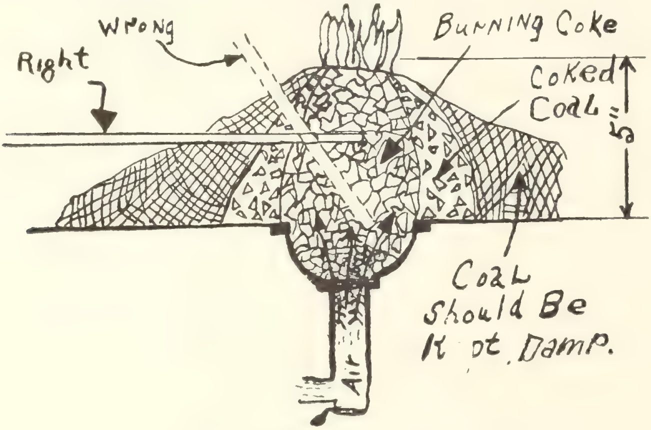


Figure 11

7. After smoke is coming from all sections of the cone-shaped mound take the poker and make a hole in the top of the mound allowing the flame to come through.

8. Enough air should be forced through the fire to keep it burning with a great deal of heat. (Caution: An over supply of air produces a fire that causes iron to scale, thus making good welding almost impossible.)

9. Keep the edges of the mound wet to prevent the spreading of the flame.

10. As the center burns out, push in the sides of the mound, thus making the center the burning coke. Rebuild the sides with green coal as needed.

11. It is important to keep a deep fire because the iron being heated should have burning coke below, around, and above it. The only way to keep a deep fire is to keep a good mound.

12. A good fire is recognized by its clear concentrated white flame. A strong sulphur smell indicates a poor fire for welding. In order to get a good

fire there must be first, good coal; second, plenty of it. There is no use to pile a lot of coal on an old fire full of cinders and slag. The fire-pot must be kept clean at all times. It has been observed that most students are too saving with coal. They take a shovel of coal, drop it on the forge in the vicinity of the fire and sprinkle a handful of it in the fire once in a while. In such cases it is impossible to do good work and turn it out quickly. The good blacksmith has a scoop shovel and puts on one or two shovels of wet coal at a time. He then packs it in the fire firmly and keeps it sprinkled with water to keep the flame from spreading. In this way the fire is kept hard.

Home-Made Farm Anvil

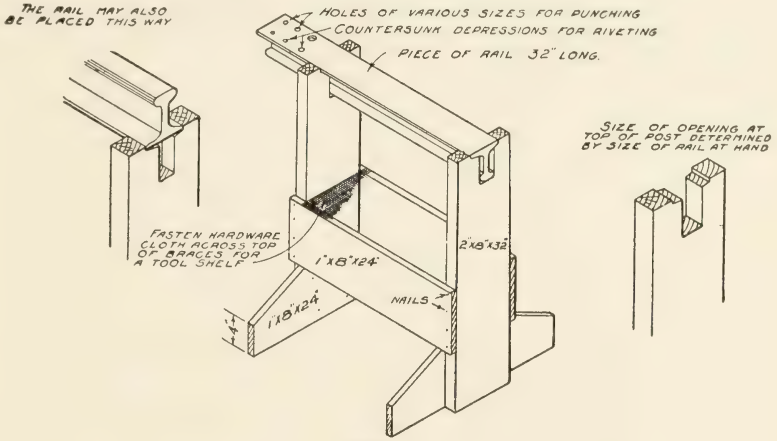

THE RAIL MAY ALSO BE PLACED THIS WAY
HOLES OF VARIOUS SIZES FOR PUNCHING
COUNTERSUNK DEPRESSIONS FOR RIVETING
PIECE OF RAIL 32" LONG.
SIZE OF OPENING AT TOP OF POST DETERMINED BY SIZE OF RAIL AT HAND
FASTEN HARDWARE CLOTH ACROSS TOP OF BRACES FOR A TOOL SHELF
2"x8"x32"
1"x8"x24"
1"x8"x24"
NAILS
4"

Figure 12

Reference: Cornell Extension Bulletin 108, "The Farm Shop and Tool Equipment."

Cutting Steel Rail for Home-Made Anvil

Take a cold steel cutter and sledge hammer and mark rail where it is to be cut. Turn rail with face of rail up. Place cold cutter on face of rail at the mark and hammer with sledge hammer. If this fails to break rail place a prise toward end of rail that piece is to be cut from and be sure to put a solid block directly under the mark of the rail. Hammer the cold steel cutter while pressure is exerted on the prise. This should break the rail very easily.

A Color Guide for Hardening and Tempering

When the material is properly heated and plunged into water and quickly removed the following colors will appear and move off the material.

The first color to appear is a very pale yellow. This is a very hard temper and is not caught for any of the ordinary tools.

The second color to appear is a light straw which approaches a grayish yellow. This temper is often caught in taps, dies, reamers, and mill cutting tools.

The third color to appear is a deep straw which approaches a brownish yellow. This temper is caught in most wood working tools, twist drills, etc.

The fourth color to appear is a light purple. This temper is caught in shears, cold chisels, punches, etc.

The fifth color to appear is a blue. This temper is caught on nearly all plows, picks and springs.

These colors appear and move off the material in the order named very rapidly and one must be on the alert to see and catch them.

Sharpening and Shaping Plows and Plow Shares

It is possible and practical for a farmer to have shop equipment necessary for sharpening and shaping his plows and plow shares. Some of them do, while the majority have to hire the village blacksmith, if one is available, to do this work for them. All farmers and farm boys have experienced the extra energy required to plow when plowing with a dull plow or plow share. Why not learn to fit our own plows and save energy and money? It is well for beginners to have patterns of plows and plow shares with correct set, when sharpening plows.

Materials Needed:

Coal
Plows and water

A. Sharpening a plow share. (The plow share is often referred to by farmers as a turning plow point). Soft center or solid steel. Cast iron shares can't be sharpened by heating.

Directions:

1. Build a clean deep forge fire.
2. Place the point of the share flat in the forge fire and heat to a low cherry red.
3. Remove the share from the fire, place heated point flat on the anvil and hammer from the top side until the point is sharp. Hammering should not be done at a heat higher than cherry red. Where point is worn thin, it should be upset slightly (this means hammering inward to thicken) before hammering out. See drawing for angle across point.
4. Heat only as much of the cutting edge as you can work before the cherry heat leaves. Repeat the heating process until the entire cutting edge is sharp. The cutting edge should be drawn from the under side. Always

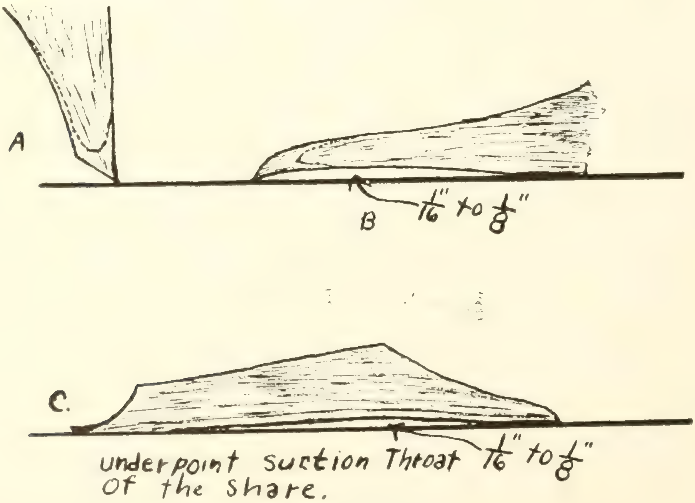


Figure 13

have the portion that is being hammered flat on the anvil.

5. Care should be taken not to heat the body of the share any more than is necessary. This will help to prevent warping.

6. Do not allow the point of the share on the side next to "land" to become curved. If worn round or curved, heat and reshape as indicated in figure 13a.

Figure 13a and b show by dotted lines how a plow share may become worn, thus making proper penetration difficult. The heavy lines show the correct shape and set when the share is properly sharpened.

7. When the share is finished, the immediate point should rest flat on surface just back of the point and the cutting edge should be raised gradually about ⅛" to give suction as indicated in figure 13b. Figure 13c shows clearance under cutting edge of the share.

8. Temper by heating the entire cutting edge of the share uniformly to dull cherry red.

9. Plunge point and cutting edge into a tub of cold water and pull out quickly, repeat two or three times. Remove and watch the blue color appear. Then drop immediately into the tub of water and allow to cool. If cooled before the blue color appears, the point and cutting edge will be too hard and will break easily.

10. The solid steel share is not to be tempered.

11. Do not attempt sharpening chilled shares by heating, but instead, grind the point and cutting edge on emery.

12. File or grind edge smooth and sharp.

B. Sharpening a half shovel plow.

1. Get a good clean fire going in the forge.

2. Place in the fire and heat to a light red heat.

3. Place on the anvil hardie and trim to a point.

4. Reheat and upset the cutting edge. (This means thickening the cutting edge).

5. Reheat and draw out cutting edge about ¾" to 1 " by hammering on top side while the edge is at a good red heat. It may take several heatings to get the hammering finished.

6. After the cutting edge has been hammered sharp, place the plow in a vise with the cutting edge up, and with a bastard file or large mill file, smooth off. This can best be done while the plow is still hot. An emery may be used for this purpose also. In this case it is better to let plow cool so that it can be held in the hand.

7. Temper as described under sharpening a plow share.

C. Sharpening scooters and straight shovels.

1. Get a good clean fire going in the forge.

2. Heat the cutting edge to a good heat. A light red heat is sufficient.

3. In most cases the points are worn to such extent that it is necessary to trim them back to the proper shape.

4. If the point is not trimmed, it will need upsetting. (This is done by hammering straight into the edge while the edge is red with heat.)

5. After shaping the point, draw out the cutting edge. This is done by heating a portion of the edge at a time. Begin at the point and finish as you go. Better results can be obtained by hammering on the under side of the edge.

6. When the edge is hammered sharp, take a bastard file or large mill file and smooth the edge. An emery may be used for this purpose also.

7. Temper as described under tempering a plow share.

D. Sharpening Solid Sweeps.

1. Place edge to be sharpened in fire and heat to cherry red.

2. Hold edge of sweep on anvil and with hammer draw out to sharp edge by hammering on under side. (Starkville blacksmiths disagree on which side of point to beat sweep to obtain correct bevel. One said, "Put bottom of sweep next to anvil and hammer on top so as to give shape on bottom of sweep. This keeps sharp cutting edge next to the ground. If sharpened on bottom side a flat surface would be against the ground instead of sharp cutting edge." Another said, "If sharpened from top it leaves bevel on top, and won't take ground as good. If sharpened from bottom, leaves bevel smooth top and sweep runs smooth.")

3. Do not work with dull heat.

4. When the edge is drawn out, temper by:

a. Heating to cherry red.

b. Plunge edge into water, leave for about 3 seconds and pull out; now observe straw color move off the edge of sweep, then the blue will follow. When the blue appears plunge immediately into water and cool.

c. If you want medium hard don't heat sweep quite to cherry red before dipping into water. Dip into water at intervals of 3 to 4 seconds until cool.

d. Sharpen edge with file or emery stone before or after tempering.

E. Sharpening heel sweeps.

1. Place heel sweeps with outside tip into forge fire.

2. Heat to a cherry red.

3. Begin at one tip and heat and work small portion at time working up the cutting edge toward center. Finish drawing out one wing before starting on the other end.

4. Hammer and draw out on lower side with a bevel of ⅔" to 1" wide.

5. Do not sharpen center, that is, the part that fits on plow foot.

6. Then start on opposite wing and do work as in 1 to 5.

7. You may grind or file cutting edge before or after tempering.

8. If you want a medium temper, dip heel sweep into water without heating to a cherry red at intervals of 3 to 4 seconds until cool.

9. If you want a hard temper:

a. Heat to cherry red.

b. Plunge into water 3 seconds then take out and observe the colors move off.

c. When it turns pigeon blue, put back in water immediately and cool. A straw color is too hard. It makes the cutting edge brittle and easily gapped or broken.

10. Shape of heel sweep.

a. Hold sweep level on flat surface.

b. If it rests down on all parts of wing, it is in shape.

c. If not you may beat out to shape with hammer.

d. Flat iron surface is best to beat on.

e. The wings may be spread to widen furrow and closed in to cut smaller furrow. This is governed by the desire of the farmer.

Reference: Farm Shop Jobs, Ag. Ed., Vol. 14, 1-4, Clemson College, South Carolina.

An Old Turn Plow Beam Made Into Useful Plow

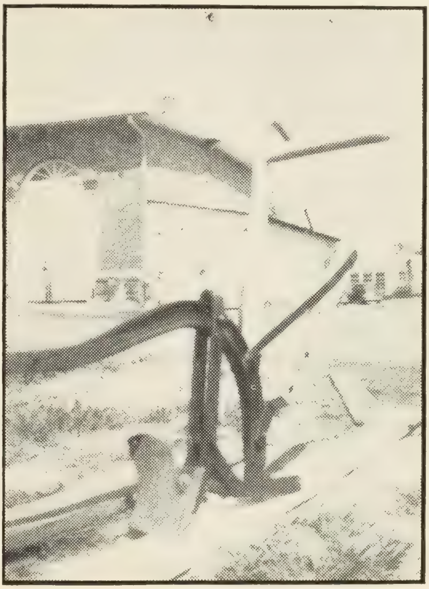


Figure 14

This plow was made from a discarded turning plow beam. The following procedure was used in making the plow shown here. The foot was made first. The material used in the foot was ½"x1½" bar iron. The beam was set upright and a measurement taken from the ground over the top of the beam back to the ground. Two inches were allowed at the top for free movement at point of adjustment on beam. A Georgia stock foot was used to get the proper curve in bottom of foot. At the extreme bottom of the foot two pieces ½"x1½"x1½" were put between the pieces of the foot and firmly riveted in place. Next a ½" hole was bored through the foot at a point 7" from bottom. The slide was made of ½"x1½" bar iron doubled, and the bottom of beam placed between these pieces and riveted. The slide should be at least 16" long. The slide should be bent up at an angle of about 45°. This will necessitate bending the slide approximately 7" from front end. All bending and shaping was done before riveting together. One-half inch adjustment holes were bored at 1" intervals along the beam where the foot goes over. A "slot" 2" long and ½" wide was cut through the top part of the foot to allow for adjustment. The plow was assembled as indicated in the picture.

SOLDERING AND SOLDERING JOBS ON THE FARM

The farmer will find that on many occasions a knowledge of the general principles of soldering is very useful and economical not only in a saving of time but in money as well. The repairing of milk cans, pails, kitchen utensils, metal roofs, lead pipes and many other repair jobs calls for a knowledge of soldering.

On many farms a great deal of useful equipment is discarded that could be repaired by soldering in a very few minutes at very little cost.

Soldering is quite simple if the following steps are observed:

1. Keep the soldering copper clean and the point well tinned at all times. The copper must be kept hot enough to melt solder readily.

2. Thoroughly clean the metal to be soldered by scraping with an old file. A clean, bright surface is necessary for a good soldering job.

3. Apply a good flux to the surface to be soldered unless an acid or resin

core solder is used. This keeps the surface clean and helps in obtaining an even flow of solder.

4. In case two pieces are to be "sweated" together the surfaces to be united must have a coating of solder between them and heated above the melting point of the solder. This is usually done by holding the soldering copper against them.

5. In cases where a seam or joint is to be soldered, the work should be held so that the solder will flow into the joints to be united.

Fluxes

The primary functions of the fluxes are to prevent the formation of an oxide previous to and during the soldering process; and to make it possible for the solder to flow evenly and readily, thus causing it to unite more firmly with the surfaces to be joined.

The most commonly used flux in farm soldering is chloride of zinc. This flux can be obtained from any tinner or it may be made as follows: Take a clean, dry quart jar and pour in some muriatic acid. Take some small pieces of metallic zinc, add these small pieces slowly to the muriatic acid, until the acid ceases to bubble and a piece of metal remains undissolved in the bottom of the jar. Due to injurious fumes given off, it is suggested that this work be done in the open. Allow this solution to settle and pour off the clear portion. Apply the flux to the surface with a wooden swab. This flux does not work well on old galvanized iron and old zinc. For soldering new metal dilute this flux by adding ¼ by volume of clean water.

Muriatic acid is commonly used as a flux in soldering old galvanized iron and old zinc. Apply this flux with a wooden stick, being careful not to let the acid come in contact with the hands. When the soldering job is completed, wash all excessive acid from the metal.

There are several brands of soldering paste sold on the market. These pastes are compounds of several fluxes with tallow and other materials. In using pastes follow directions on the box.

Powdered resin is used as a flux, and works very nicely on new tin or copper. A thin varnish of resin and denatured alcohol works well on such materials. In soldering electrical wiring, a paste of resin and tallow should be used, rather than any of the acid fluxes as the acid fluxes are likely to cause troublesome corrosion.

Wire solder can be bought with the flux compounded in a small hole in the center of the wire. On the market such solder is called "acid core" or "resin core."

Simple Method of Tinning a Soldering Copper

1. Heat the copper. Take an old mill file or bastard file and file point until a smooth, clean copper appears.

2. Place copper back in flame and let it heat until hot enough to melt solder readily.

3. Take a piece of acid core solder and melt on soldering copper. Turn the soldering copper so as to get solder on all sides of the point.

4. Wipe excessive solder off with clean cloth or waste. It is now ready to use.

NOTE: Use only acid core solder.

A Home-Made Soldering Furnace

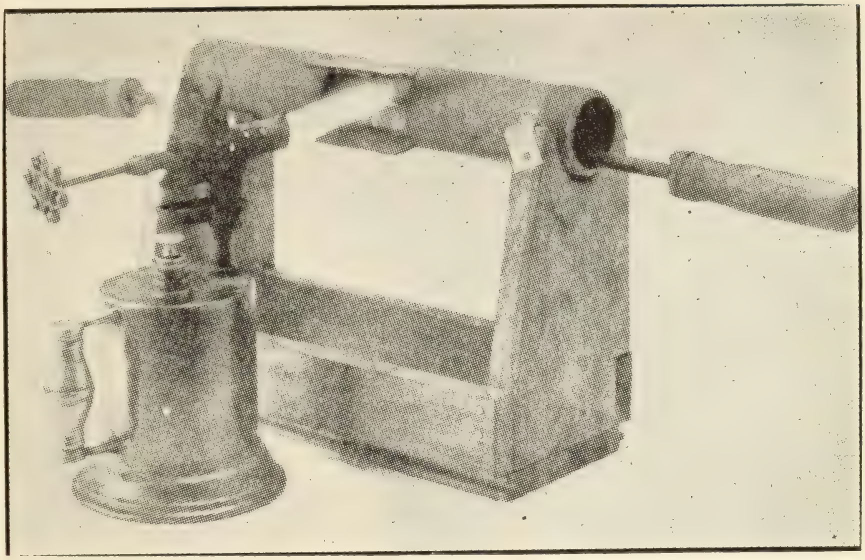


Figure 15

A homemade furnace, very simple in construction, which enables one to heat several irons at once, is shown in figure 15. The length of this furnace is 14 inches over all. The pipe used is 2 inches in diameter, and the cut in the center of it is 3 inches long and 2 inches deep. The two vertical cuts are made with a hack saw, and the horizontal cut with a cold chisel, the pipe being slipped over another pipe which is held firmly in a vise. The thickness of each end board is ⅞ inch, the width 6 inches at the bottom and 4 inches at the top, and the height 9 inches. The grooves in the end boards which receive the pipe are made 1½ inches deep. The wooden braces at the bottom (¾ by 1½ by 14 inches) may both be recessed as shown, if desired. The bottom board measures 6x⅞x14 inches.

NOTE: The hole in the pipe can be cut through the back, thus allowing the flame to pass through.

Reference: Cornell Extension Bulletin 57, "Soldering."

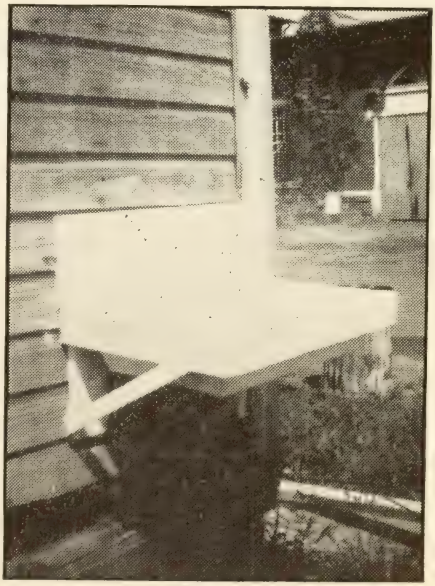


Figure 16

Making a Kitchen Sink

Directions:

1. Lay out pattern on sheet of stiff wrapping paper or piece of sheet metal to dimensions shown in drawing. Cut on all solid lines.
2. Place pattern on 28 gauge sheet metal and mark off.
3. Cut on all solid lines.
4. Bend on all dotted lines as

indicated in drawing.

5. Rivet each corner at place where ⅛″ holes are made.

6. Solder all seams and corners.

7. Make ¼″ holes in circles in bottom of sink, and take a ball pein hammer and dish the area of the holes.

8. Make spout of desired length, usually about 6″ or 8″ is sufficient, by bending a piece of sheet metal of desired length and width around a piece of 1½″ pipe. Solder the seam, then cut down about ½″ parallel strips and flange out, then solder beneath the ¼″ holes in the sink.

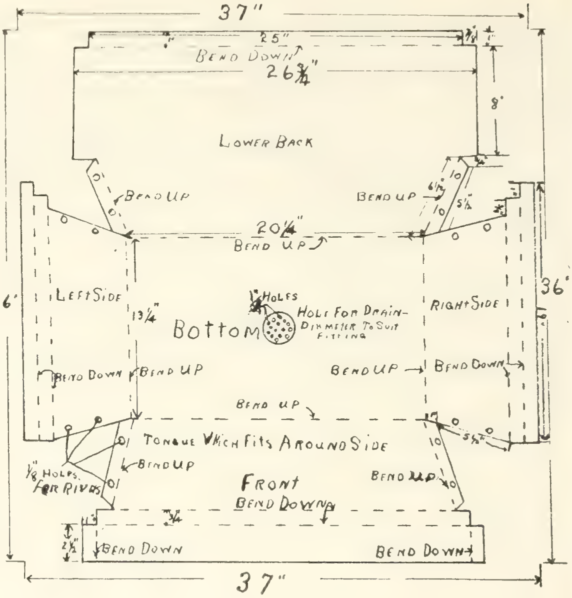

37″
25″
Bend Down
26¾″
8″
Lower Back
Bend Up
Bend Up
20¼″
Bend Up
Left Side
13¼″
Holes
Bottom
Hole For Drain-Diameter To Suit Fitting
Right Side
36″
36″
Bend Down
Bend Up
Bend Up
Bend Down
Bend Up
Tongue Which Fits Around Side
⅛″ Holes For Rivets
Bend Up
Front
Bend Up
Bend Down
¾
Bend Down
Bend Down
37″

Figure 17

9. Boards should be fitted on sides and back of sink to give rigidity. (See picture for plan of framing for sink). The ends of side boards should be mitered to give a nicer finish.

10. Nail the flange of sink to face of wooden frame with small nails.

11. Apply two coats of flat white paint and follow with two coats of white enamel. This, if properly done, will give an attractive sink.

Making a Two-Quart Scoop

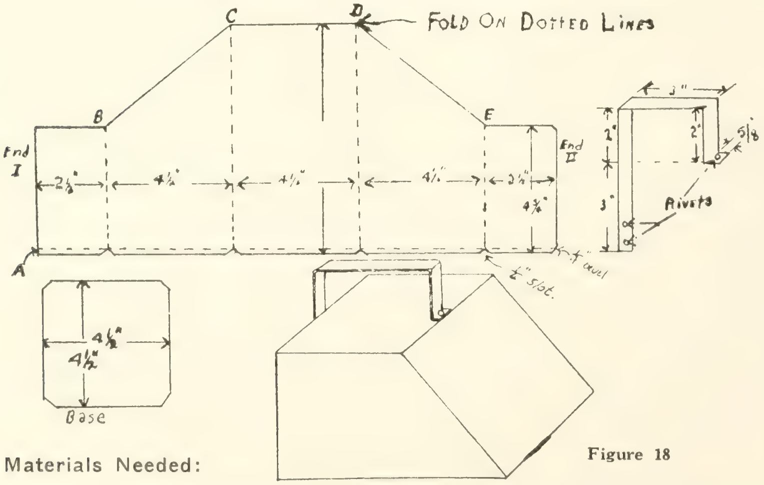

C
D
Fold On Dotted Lines
B
E
End I
End II
2½″
4½″
4½″
4½″
2½″
4¼″
A
¼″ slot
¼″ curl
3″
2″
2″
5/8
3″
Rivets
4½″
4½″
Base

Figure 18

Materials Needed:

Sheet metal, 28 gauge, 8-¼″x18-½″ for folding to make sides; 1 piece 4½″x4½″ for base
Handle iron, ⅛″x1″x11″
Rivets and solder

Directions:

1. Obtain pattern of desired scoop.
2. Place pattern on sheet metal and mark off.
3. Cut along marked lines, trim corners, and cut out other marked slots along the pattern.
4. Cut off 11" of a piece of flat iron ⅛"x1" for handle. Shape handle in vice.
5. Fold as follows:
   Bend downward along dotted line A and hammer to right angle.
   Bend inward at B and hammer to right angle.
   Bend inward at C and hammer to right angle.
   Bend inward at D and hammer to right angle.
   Bend inward at E and hammer to right angle.
   End I will lap over end II one-half inch.
6. Place ½" band of solder on top of end 2.
7. Place end I over end II at proper distance to make width equal 4½" as other sides.
8. Solder together by sweating with hot copper. Smooth by pulling point of hot copper rapidly down edge.
9. Place a band of solder ¼" wide around edge of base.
10. Place base inside scoop with soldering side down. Solder by sweating as in step 8.
11. Drill holes for handle.
12. Place handle on with rivets as shown in drawing.

NOTE: All surfaces must be thoroughly cleaned before applying solder.

HOME-MADE FARM EQUIPMENT AND HOME CONVENIENCES

There are times when practically every farmer is called upon to use his "inventive power" and "mechanical talents," if he is to have the farm equipment and conveniences necessary to lighten his task. The home-made equipment and conveniences shown in this section are illustrations of practical projects that can be used profitably on any farm. Some of the projects shown can be made from scrap material.

Building a Wagon Box

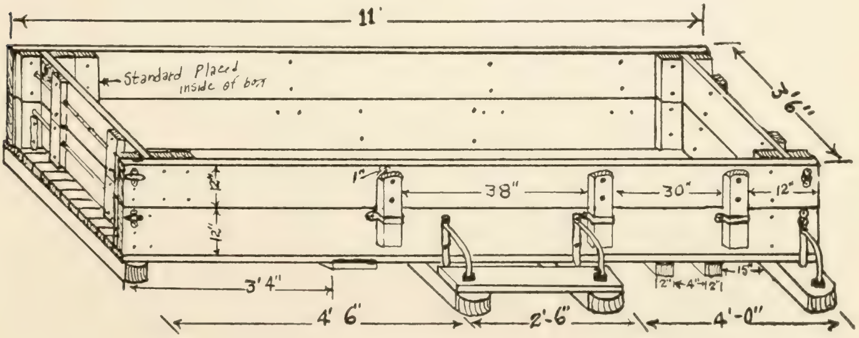


Figure 19

Materials Needed:

A. Lumber:

13 pieces 1"x4"x11', tongue and groove flooring (hardwood or edge-grain pine)
4 pieces 1"x12"x11' for sides
4 pieces 1"x12"x40" for end gates (if ¾" sides are used, cut end 40½")
2 pieces 2"x4"x54" for middle cross sills (oak or hickory)
1 piece 2"x3"x54" for back cross sill (oak or hickory)
1 piece 2"x3"x43" for front cross sill (oak or hickory)
24 pieces 1"x2"x12" for cleats
8 pieces 1"x2"x21" for standards on top side planks
2 pieces 2"x2"x42" for bolster cleats
2 pieces 1"x4"x30" for steps

B. Hardware:

Six side braces, 2 rub irons, 8 wagon box straps, 4-44" wagon rods, 60 feet of beveled edge top strap iron, 110 wagon box rivets or carriage bolts ¼" by varying lengths, according to place used, ½ lb. ¼" wrought iron washers. About 1 pound 8d common nails.

Directions:

1. Cut all pieces to stock as called for in bill of materials and drawing.
2. Round end of cross sills by sawing off each corner and using rasp.
3. Properly space cross sills as called for in drawing. This can best be done by placing the sills on a flat surface and tacking them in place with strips. When the pieces are tacked in place, turn the frame work over and be sure that each piece is properly spaced.
4. Remove the groove from the first piece of flooring.
5. Place on cross sills and nail. Place next piece of floor on, draw up tightly and nail in the tongue on each cross-sill. Remove the tongue from the last piece and nail from the top so that side planks will cover head of nails.
6. Place the irons and cleats on the sides as indicated in drawing.
7. Place sides upright and properly place on flooring and sills and mark places for holes and bore them.
8. Put on side steps as indicated in drawing.
9. Place on side brace irons as indicated in drawing.
10. Adjust brace nuts so that sides will be at right angles with the floor.
11. Place cleats on side board and end gates as indicated in drawing.
12. Fit end gates and place wagon rods through the cleats on the end gates as indicated in drawing.
13. Tighten all nuts and rods and check for squareness.
14. Screw on strap irons on top of sides.
15. Place rub irons as indicated in drawing. (A piece of angle iron may be used.)
16. Place on bolster-cleats indicated in drawing.
17. Paint outside of box green and stain inside with red shingle stain. It will add to the appearance of the box to strip it with ½" yellow strips, however, this takes considerable time.

NOTE: Before placing the strap irons on the front and back, take the hack saw and cut enough of the upper end off to allow the rod to pass without interference. About 4 inches should be left between the top of these irons and the top edge of sides.

Home-Made Stalk Cutter

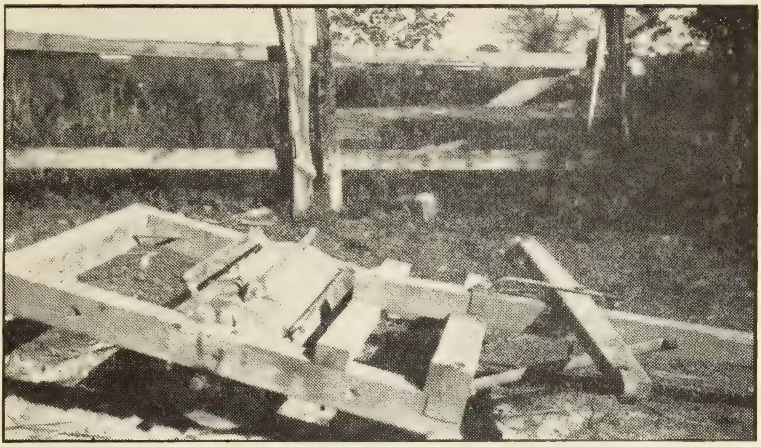


Figure 20

Materials Needed:

2 pieces 4"x4"x5'
2 pieces 4"x4"x4'
2 pieces 2"x4"x4'
1 piece 4"x4"x12'
Oak lumber should be used
1 block 15"x3'-4" (round)
9 bolts ½"x5"
3 bolts ½"x7"

3 bolts ½"x8"
4 pieces wrought iron rod ½"x16"
2 pieces strap iron ⅜"x2"x3'
16 pieces strap iron ⅜"x1½"x8"
8 pieces grader blade 3' long
16 bolts ⅜"x1½"
2 pieces car axle or drive shaft 14" long

Directions:

1. Cut two pieces 4"x4"x5' for side pieces and mortise as shown in picture.

2. Cut two pieces 4"x4"x4' and two pieces 2"x4"x4' for end pieces, mortise and bolt together as shown in picture.

3. Cut 4 pieces wrought iron rod ½"x16" and thread. Bore holes and put in corner braces.

4. Cut 1 piece 4"x4"x12' for tongue. Bevel the edges of the tongue beyond the evener. Bolt tongue to the two end cross pieces.

5. Cut two pieces strap iron ⅜"x2"x3' and make tongue braces and bolt on as in picture.

6. Cut a block 3'-4" long and 15" in diameter from a tupelo gum, elm, or some hardwood tree, for the drum of the cutter. Mark the block and work perfectly round. Start 4 inches from each end of drum and hollow out toward center about 3 inches deep.

7. Cut two pieces of car axle or drive shaft 14 inches long and drive in center of drum 8" deep.

8. Cut 16 pieces ⅜"x1½"x8" strap iron, sharpen one end of each piece and bore one ⅜" hole in other end 1" from end. These are to hold the cutting blades. Mark off drum with eight parallel lines equi-distant around the drum. Start three inches from each end of drum and drive each piece of 8" strap iron 4" deep in the drum on the lines that were marked.

9. Cut eight pieces of old grader blades 3 feet long, forge to sharp edge and bore holes to correspond with holes in pieces of strap iron driven in the drum, and bolt on with ⅜"x1½" bolts.

10. Take two old model "T" Ford connecting rod bearings and bolt over end of rod in center of side frame to hold the drum in place.

11. The width of this cutter may be increased if desired.

12. Bolt on all other pieces as shown in drawing.

Building a Four Wheel Farm Trailer

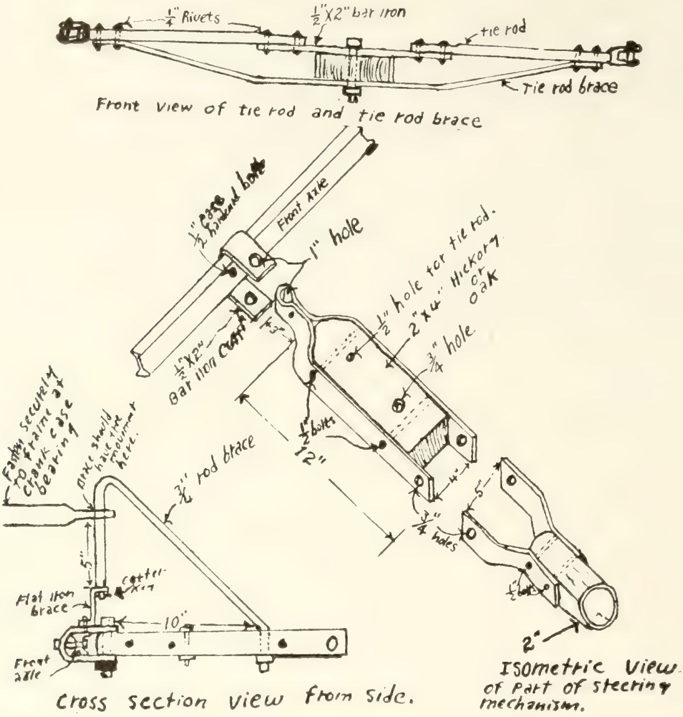

¼" Rivets
½"X2" bar iron
tie rod
Tie rod brace
Front view of tie rod and tie rod brace
½" case hardened bolt
Front axle
1" hole
½" hole for tie rod.
2"x4" Hickory or oak
¾" hole
½"X2" Bar iron clamp
3"
½" bolts
12"
4"
5"
¾" holes
½" bolts
2"
Isometric view of part of steering mechanism.
Fasten securely to frame at crank case bearing
brace should have free movement here.
¾" rod brace
5"
cotter key
Flat iron brace
10"
Front axle
Cross section view from side.

Figure 21

Materials Needed:

1 Model "T" Ford chassis
10'-½"x2" bar iron for frame work of steering mechanism and tongue
7'-¼"x1" bar iron for braces
4'-2" iron pipe for tongue (trailer)
1 set of wagon box irons
3'-¾" rod iron for brace from chassis frame to platform of steering mechanism
1'-1¼" rod steel (piece car axle or drive shaft will do) for fastening rod brace to chassis frame
4'-1"x1" angle iron to be used for fastening in ends of box
2 pieces 3"x8"x4' oak for bolsters
3 pieces 2"x3"x4' oak for cross pieces on bottom of box
3 pieces 2"x4"x5' oak for cross pieces on bottom of box
2 pieces 1"x12"x11' pine or poplar for sides of box
2 pieces 1"x12"x46" pine or poplar for ends of box
15 pieces 1"x4"x11' pine tongue and grooved flooring
  (1"x6"x11' planks may be used instead of tongue and grooved flooring)
1 piece 2"x4"x4' hickory for use in frame work of steering mechanism and tongue
1 piece 3"x4"x10' for wagon tongue (oak)
Nails, screws, bolts, and rivets as desired

Figure 22a shows the wagon tongue unit. 1, shows ½"x2" bar iron formed to take breast yoke. 2, shows ¼"x1" bar iron brace. 3, ½"x2" bar

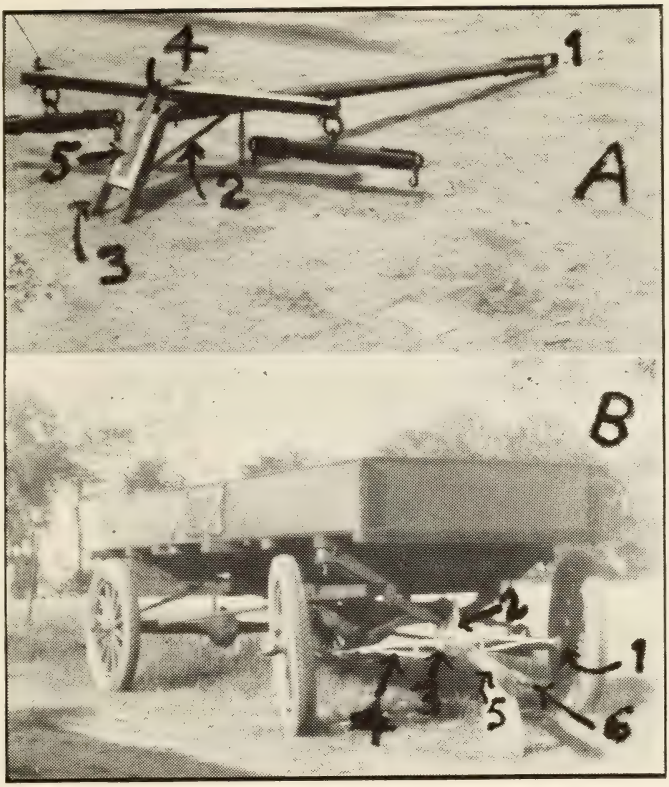


Figure 22

iron shaped to fit steering mechanism. 4, bar iron brace over double tree. 5, shows how iron brace is fastened on.

Figure 22b shows the trailer complete with steering mechanism assembled and attached. 1, shows tie rod attached to spindle arm. 2, shows ¾″ iron rod brace in place. 3, shows how tie rod and tie rod brace fits on. 4, shows how tie rod brace is fastened to the rod. 5, pipe tongue. 6, devise for attaching to car hitch.

Directions:

A. Getting chassis in shape.

1. Remove spindle arms and turn them to the front.
2. Replace all worn bushings and tighten all loose nuts.

B. Building the box on the chassis.

1. Cut the 3″x8″ pieces to desired shape and fasten to frame with ½″ bolts. Use lock washers to hold nuts on bolts. Counter sink the heads of the bolts so that they will not interfere with the placing of flooring.
2. Build box in same manner as used in building a wagon box with the exception of fastening ends in.
3. Fasten ends in by using angle iron and ¼″ carriage bolts as shown in picture.
4. The box must be securely bolted onto the bolsters.

C. Marking the steering mechanism.

1. **Caution:** The spindle arms must be taken out of the spindle and turned to the front. If the spindle arms do not loosen readily, use a blow torch to heat the spindle. This will often cause the spindle arm to slip out easily.

Do not turn the axle around to get the spindle arm to front. If this is done, the wheel nuts will tighten up and cause wheel bearings to burn out or burst.

2. Get the wheels in perfect alignment. The front of the wheels should toe in slightly, not more than ¼".

3. Cut enough of the tie rod out in the center to allow for ½"x2" bar iron. About 12" will be sufficient. See drawing.

4. Flattening about 4" on each center end of the tie rod. Lay the ends of the tie rod on bar iron and adjust length to be the same as that between ends of spindle arms. The tie rod may be fastened to spindle arms in getting this measurement. Mark places for holes. Remove and drill ¼" holes and rivet securely as shown in drawing. Bore ½" hole equi-distance from each end in the piece of bar iron.

5. Make the other parts of the steering mechanism as shown in drawings. Let the tie rod brace be the last piece to attach.

6. Assemble as shown in picture.

NOTE: A wagon tongue unit may be made similar to the one shown in figure 22a. This tongue can be attached to the steering mechanism instead of the trailer tongue by removing the ¾" bolt. Study drawings and pictures carefully before starting to work.

Building a Garden Wheelbarrow

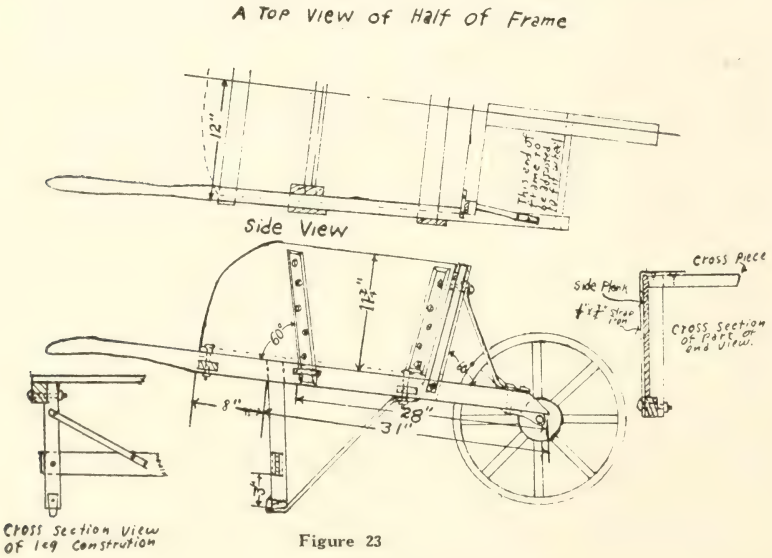

A Top View of Half of Frame
12"
This end of frame to be adjusted to fit wheel
Side View
11¾"
60°
45°
8"
28"
31"
5"
Cross Piece
Side Plank
¼"x1" strap iron
Cross Section of part of end view.
Cross Section View of leg Construction

Figure 23

(This wheelbarrow is made so that the sides can be removed. This makes dumping easier and permits carting larger objects.)

Materials Needed:

Lumber:

2 pieces 1¾"x2"x58" for handle frames
2 pieces 1¾"x2"x24" for cross framing
2 pieces 1¾"x2"x16" for front upright
1 piece 1¾"x1¾"x21" for headcross piece
2 pieces 1¾"x1¾"x16" for legs
2 pieces ¾"x11¾"x27" for sides
4 pieces ¾"x7½"x23" for floor
2 pieces ¾"x1¾"x11" for cleats
2 pieces ¾"x1¾"x13" for cleats
1 piece ¾"x2"x23" for stretcher

Hardware:

1 wheel (old or new) (an old planter wheel works satisfactory)
2 pieces ¼"x¾"x16" strap iron for front brace
2 pieces ⅛"x¾"x25" strap iron for leg brace
2 pieces ⅛"x¾"x14" strap iron for leg brace
2 pieces ⅛"x¾"x17" strap iron for side board slot
2 wagon box staples

Directions:

1. Rip handle frames from piece of oak or hickory to dimension called for in bill of materials.
2. Rip out other frame pieces as called for in bill of materials.
3. Fasten handle frames to wheel and adjust spacing for cross frame pieces by pulling handles apart so that the distance between handles at point of back across frame is 20½".
4. Mark places for cross frame pieces and mark length of the two cross frame pieces.
5. Fasten the two cross pieces to handle frames as shown in drawing, cut and fasten legs in place.
6. Nail or screw in floor and place ¼" carriage bolt through frame as shown in drawing.
7. Cut end of floor plumb with edge of handle frame.
8. Cut the end pieces and fasten end on as shown in drawing. (Note: the end plank must be cut 1½" shorter than the edge of last piece of flooring to allow for passage of side pieces under the strap iron.)
9. Cut side planks and fasten on as shown in drawing. Place front cleats so that they will rest against strap iron on front.)
10. Cut all braces to dimension called for in bill of materials and fasten on with screws or bolts.
11. Paint woodwork with two coats of green implement paint. Paint iron work with black implement paint.

Laying Out and Cutting Common Rafters

Information needed before the rafter can be marked out:

The span of the building. The span of a building is the width of the building from the outside to outside of plate.

The pitch to be used. The pitch of the roof of a building is nothing more than the slope of the roof expressed as a fraction as ¼, ⅓, ½, etc.

The run of the building. The run is ½ the span.

Directions:

A. Marking the rafter.

1. Determine the width or span of the building.
2. Take ½ the span which is the run.

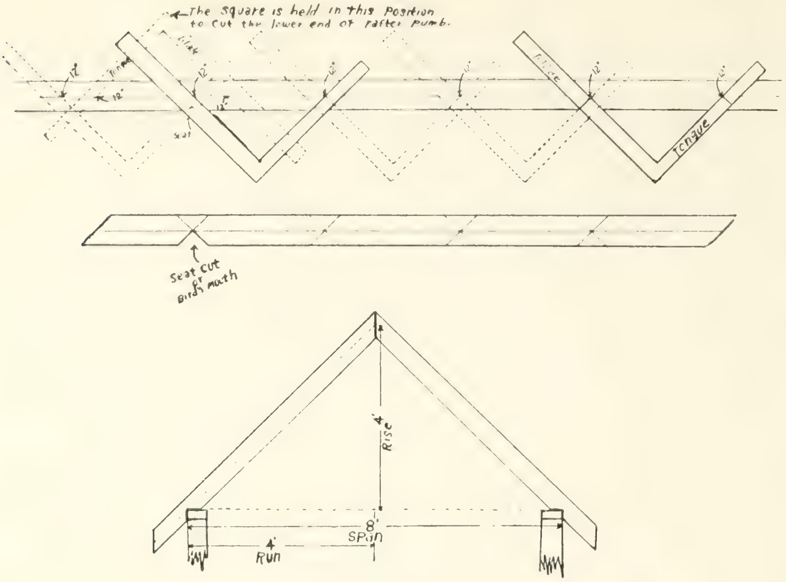

The square is held in this Position to cut the lower end of rafter pumb.
Blade
Tongue
12"
12"
Seat
Seat cut or Bird's mouth
4' Rise
8' Span
4' Run

Figure 24

3. Decide upon the pitch to be used.

4. Multiply the pitch by the span to get the rise. The rise is the height of the ridge above the plate.

5. Put all these figures down.

6. Select a straight piece of the material to be used as rafters which is usually 2″x4″ or 2″x6″.

7. Determine the center of one side and mark a line down the center from one to the other.

8. Take 12″ on the blade of the steel square, which is the long side of the square, and as many inches on the tongue of the square as there are inches of rise to the foot of run.

9. Hold these two points at the center line and begin at the upper end of the rafter with the tongue to top edge. Mark along edge of the tongue and blade on the edge of square on which points are held. (Best results can be obtained by working from inside of square.) Apply the square on the line holding these two points as many times as there are feet in the run. Study the diagram. The diagram above is graphical scale of the following problem:

A. Building with a span of 8′ and ½ pitch.

B. Cutting the rafter:

Saw the first line on the upper end. Saw the bird's mouth or rafter seat by sawing out V from center line. Saw end of the rafter plumb. The part of the rafter that sticks over from the plate is called the tail and can be any length desired. Decide on length of tail. Cut plumb by applying square as shown in diagram.

C. Determining length of rafter:

It is necessary to know the dimensions of lumber needed in building a building. This is especially true with respect to framing. In order to determine what length rafter material to buy, the length of the rafter must be determined. The rule for determining rafter length is as follows: Take as many inches on the blade of the square as there are feet in the run and as many inches on the tongue as there are feet in the rise. Measure the diagonal distance between these two points. Each inch found will represent 1 foot of rafter. Thus, in the example cited above we take 4″ on the blade and 4″ on the tongue and find that the diagonal distance between these two points is 5⅔″; therefore, the length of the rafter in feet will be 5′ and 8″.

A Handsaw Clamp

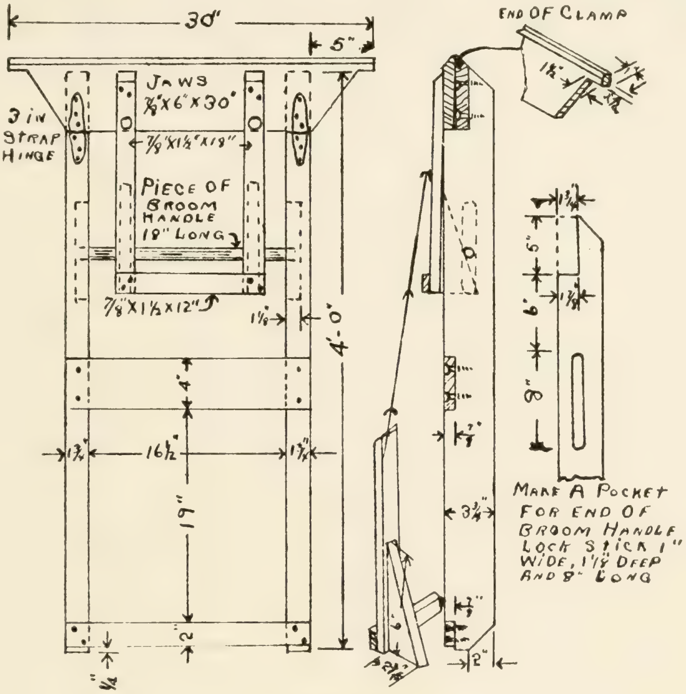

30"
5"
End of Clamp
1½"
Jaws ⅞"x6"x30"
3 in Strap Hinge
⅞"x1½"x18"
Piece of Broom Handle 18" Long
⅞"x1½x12"
1⅛"
4'-0"
4"
1¾"
16½"
1¾"
19"
2"
¾"
1¾"
5"
6"
8"
1⅛"
3¾"
2"
2¼"
Make a Pocket For End of Broom Handle Lock Stick 1" Wide, 1⅛" Deep And 8" Long

Figure 25

Materials Needed:

Lumber:

Pieces	Dimensions	Use
Two	1¾″x3¾″x 4′	Posts
One	7/8″x2″ x20″	Bottom brace
One	7/8″x4″ x20″	Middle brace
Two	7/8″x6″ x30″	Jaws
Two	7/8″x1½″x18″	Levers
One	7/8″x1½″x12″	Brace for Lever
Two	7/8″x2¾″x 9″	Lock

One piece of broomstick 18-3/8″ long for lock bar

Hardware:

Two 3-inch strap hinges

Eight 1½-inch No. 9 flathead wood screws, to assemble level and triangular lock pieces to levers

Twelve 1¾″ No. 9 or No. 10 flathead wood screws, to fasten middle and bottom braces and back jaws to posts

Two 1½″ No. 9 flathead screws and two ¼″x2″ flathead bolts, to fasten levers to jaw

Reference: Cornell Extension Bulletin 94, "Fitting the Farm Saws," Ithaca, New York.

Making a Two-Horse Evener

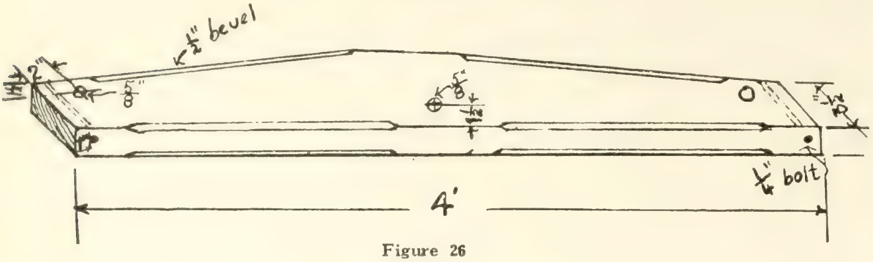


Figure 26

Materials Needed:

1 piece oak or hickory 1¾"x4½"x4'
2-¼"x4" carriage bolts

Directions:

1. Select a good straight piece of oak or hickory and cut to the dimensions indicated in figure 26.
2. Dress all rough edges off with jack plane.
3. Take the steel square and measure ½ the length of the piece or two feet. Mark this point by drawing a pencil line across one surface.
4. On the same surface, measure 1" from the edge on both ends and mark.
5. Take the steel square and mark a line from the back edge of the piece at the line in the center to the point 1" from the back edge on the end. Repeat the process for the other end.
6. Turn the piece edgewise, measure 1" from each end and bore the ¼" holes as indicated in drawing.
7. Measure 1½" from the back edge and 2" from the ends and bore the ⅝" holes as indicated in drawing.
8. Measure 1½" from the front edge on the line that has been marked as the center and bore another ⅝" hole.
9. Place the ¼" bolts in place, tighten and brad nuts on.
10. Apply one or two coats of red or green implement paint.

NOTE: The life and strength of the evener can be increased by boring the holes large enough to receive a ⅝" pipe, cut the pieces of pipe ¼" longer than the thickness of the evener. Drive the pieces of pipe in the holes and batter the outer edge of each end so that the piece of pipe will be held tightly in place.

Building a Lawn Set and Lawn Table

Materials Needed:

A. Lumber for two chairs:

4 pieces ¾"x3¾"x22" for front uprights
4 pieces ¾"x3¾"x22" for upright back supports
4 pieces ¾"x5¾"x30" for long seat supports
4 pieces ¾"x7¾"x26" for arms
4 pieces ¾"x5¾"x15" for arm supports
4 pieces ¾"x3¾"x21" for front and back cross rails
2 pieces ¾"x3¾"x27" for upper back cross rails
10 pieces ¾"x3½"x19½" for seat slats
6 pieces ¾"x3¾"x33" for back slats

B. Lumber for double chair or settee:

2 pieces ¾"x3¾"x22" for front uprights
2 pieces ¾"x3¾"x22" for upright back supports
2 pieces ¾"x5¾"x30" for long seat supports
2 pieces ¾"x7¾"x26" for arms
2 pieces ¾"x5¾"x15" for arm supports
2 pieces ¾"x3¾"x42" for front and back cross rails
1 piece ¾"x3¾"x48" for upper cross rail
5 pieces ¾"x3½"x40½" for seat slats
7 pieces ¾"x3¾"x33" for slats

C. Other materials:

6d and 8d finishing nails
2 quarts outside white paint. (Porch or deck paint works very nicely on this set)

D. Lumber for lawn table:

4 pieces 1¾"x1¾"x30" for legs
4 pieces ¾"x3¾"x21" for side rails
2 pieces ¾"x2"x33" for diagonal braces near bottom of legs
7 pieces ¾"x3¾"x28" for top

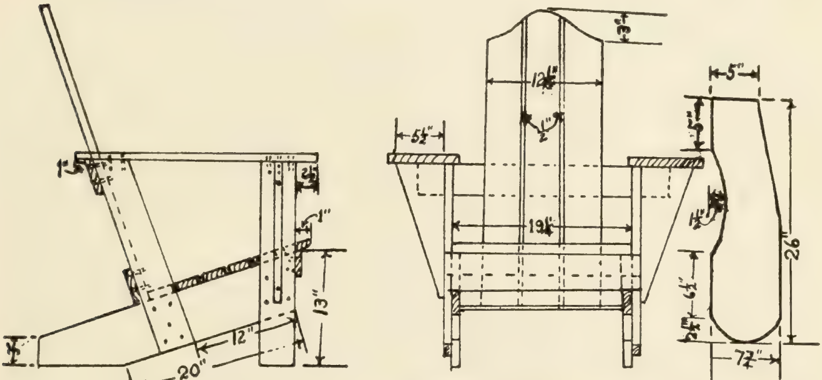


Figure 27

Directions:

1. Mark and cut all pieces to stock as called for in bill of material and sketches.

2. Shape end of back pieces as shown in drawing.

3. Shape all arm pieces as shown in drawing.

4. Saw arm support by starting ¼" from lower corner, as indicated in drawing and saw straight to ¼" of outside of top corner.

5. Bevel upper back support on level with arm piece.

6. Place front rail so that top edge will be 13" from bottom of front upright piece.

7. Nail all pieces in place as shown in drawing with 6d or 8d nails.

8. Nail all pieces securely and

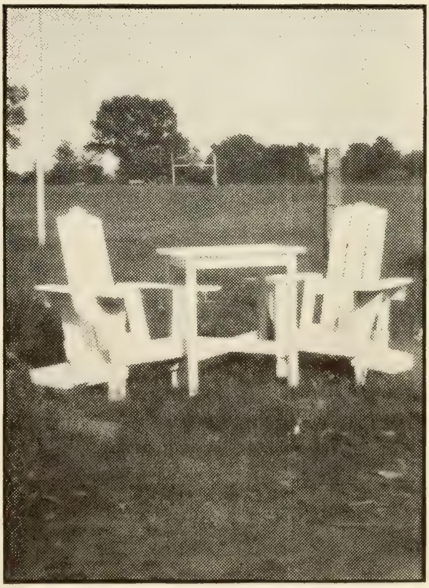


Figure 28

countersink heads of all nails.

9. Sandpaper all the surface to a smooth finish.

10. Put on a thin coat of paint, brush in well and allow to dry thoroughly before applying second coat.

11. Sandpaper lightly with worn sandpaper.

12. Put on a second coat of a good grade of outside paint. Porch or deck paint may be used with satisfactory results.

Lawn Bench

Materials Needed:

Lumber:

- 5 pieces 1"x4"x48", seat slats
- 2 pieces 2"x12"x12¼", legs
- 4 pieces 2"x2"x18", caps and feet
- 1 piece 2"x4"x46", tie rod, cut hole in leg 2"x2" and notch tie rod to fit
- 2 wooden pins

Common nails, 20d and 12d

Directions:

1. Cut all pieces to dimensions called for in bill of materials.

2. Saw ends of seat slats, caps and feet at 45° angle and sand to smooth rounding edge.

3. Shape legs as indicated in picture.

4. Cut hole through legs and notch tie rod to fit. Fasten legs together by means of tie rod and wooden pin. The wooden pins should be ½"x4" and tapered so that they will tighten up as they are driven in.

5. Nail on caps and feet with 20d nails.

6. Nail on seat slats with 12d nails.

7. Countersink all nail heads and sand smooth with No. 1 sand paper.

8. Apply two or three coats of good grade exterior white paint.

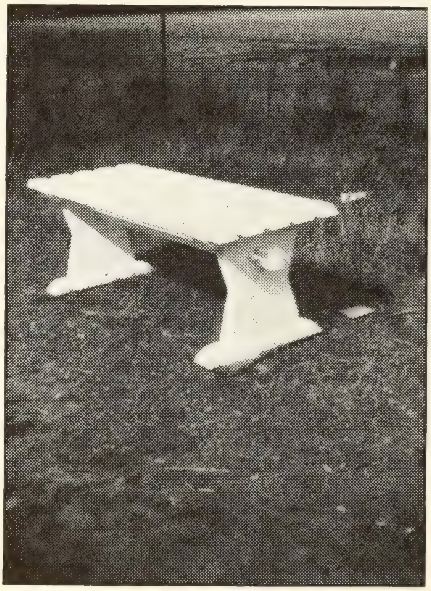


Figure 29

NOTE: If bench seat sags or is too limber, fasten a 1"x4" strip across bottom of seat slats at middle. This will strengthen the seat and will prevent individual slats from sagging.

Porch Swing

Materials Needed:

- 3 pieces 1"x4"x20", seat supporters
- 2 pieces 1"x4"x12", front post
- 3 pieces 1"x4"x20", back post
- 2 pieces 1"x4"x24", arm
- 2 pieces 1"x2"x22", arm support
- 1 piece 1"x4"x42", front of swing across ends of seat supporters
- 7 pieces 1"x2"x42", swing floor
- 1 piece 1"x2"x42", across top of back post
- 15 pieces 1"x2"x17", back of swing

1 piece 1″x1″x42″ for back strip brace
5 bolts ¼″x2″, carriage bolts to fasten post to seat supporters
4 hammock hooks to hang swing

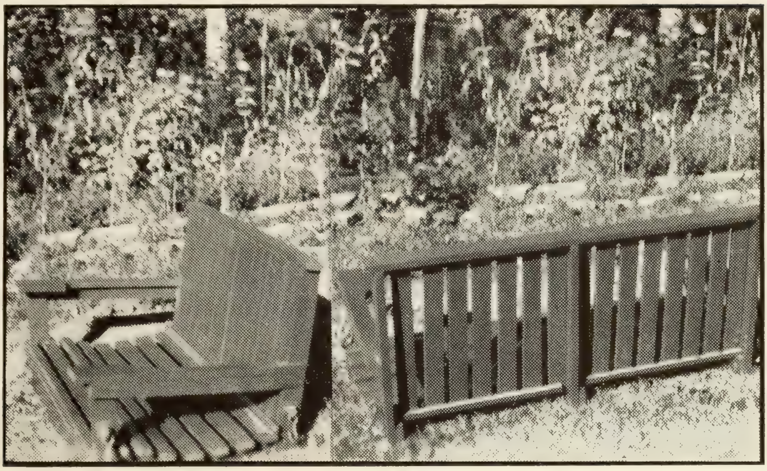


Figure 30

Directions:

1. Cut 3 pieces 1″x4″x20″ for seat supporters. Hollow these pieces to give a curve in floor of swing.

2. Cut 2 pieces 1″x4″x12″ for front post, fasten post to seat supporters with ¼″x2″ bolts.

3. Cut 3 pieces 1″x4″x20″ for back post. Fasten back post to seat supporters with ¼″x2″ bolts at approximately 105° angle to sleepers.

4. Cut 1 piece 1″x4″x42″, fasten across front of swing at ends of seat supporters.

5. Cut 4 pieces 1″x4″x42″ and rip in center to floor swing. Leave 7/8″ space between floor strips. Bevel back edge of back seat strip to fit angle of back of swing. (Nail with 6d finishing or casing nails and countersink all nail heads.)

6. Cut back post diagonally so that top end will be two inches wide and bottom end 4″ wide. Cut 1 piece 1″x2″x42″ and fasten across top of back post.

7. Cut 8 pieces 1″x4″x17″ and rip in center for back strips, leave 7/8″ space between strips. Nail top of back strips in by nailing through from top of back top cross strip with 4d finishing nails. Nail bottom of back strips in by nailing through from back into the edge of back seat strip.

8. Cut piece 1″x1″ and fasten across top of seat supporters behind back strips.

9. Cut 2 pieces 1″x4″x24″, hollow or curve as much as desired and fasten on for arm as shown in picture.

10. Cut 2 pieces 1″x2″x22″ and fasten under arm to front and back post to brace arm.

11. Fasten hammock hooks to front and back post with stove bolts as shown in picture.

12. The length of the swing may be increased as desired.

13. Paint with two coats of paint of color desired.

HANDY FARM DEVICES

Home-Made Cane Knife

Here is a cane knife that is easily made. A butcher knife blade may be used but a piece of old grain cradle blade about the same size is better. Instead of riveting blade to handle use a link of a trace chain. Flatten two sides of one end of the stick used for the handle so the link will fit, then insert blade through split and link will not slip. Length of link and width of handle will regulate the pitch of the blade.

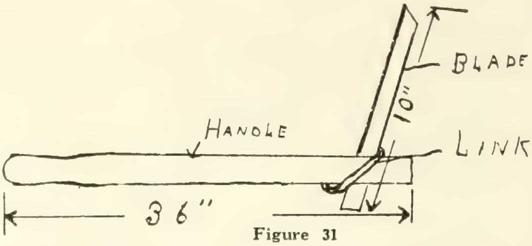


Figure 31

Charles B. Graham,
King William County, Virginia.

Simple Post Brace

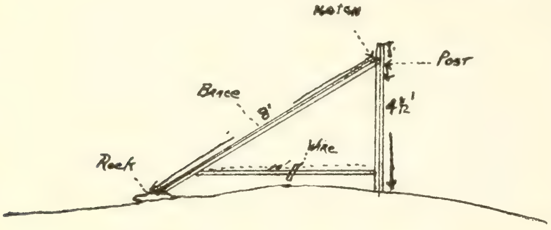


Figure 32

It is not necessary to set an extra post to brace a corner post if the bracing is done as shown here. The flat rock keeps the brace from sinking into ground and the wire holds it tight.

Ivy M. Howard.

Hinges From Old Horse-Shoes

Hinges made from old horse-shoes by bending the ends of them as shown in the accompanying illustrations, give a door or gate a rustic, attractive appearance and last indefinitely.

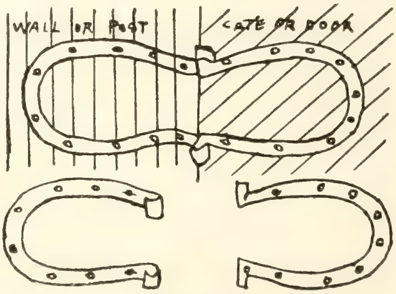


Figure 33

Ivy M. Howard,
Payne County, Okla.

Home-Made Shower

This easy-to-make shower bath room is six feet square and seven feet

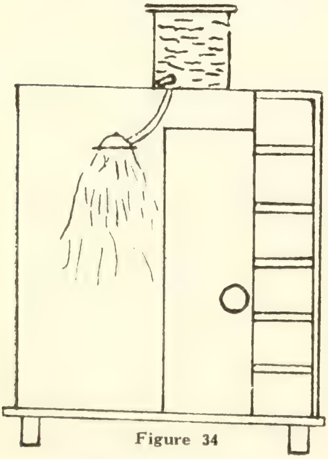


Figure 34

high. It is floored, has water outlet, door, small window, towel bar, soap tray, bath stool, and mirror attached to wall with small dressing table under mirror for combs and brushes. The 40-gallon tank is made of an old stove tank, or a barrel can be used. The tank is filled early in the morning so the sun can warm the water. The hose line of rubber tubing is 2½ feet long with a stationary spray head. I hope many more farm people will enjoy such a shower bath as we do.

M. L. S.

Hingeless Gate

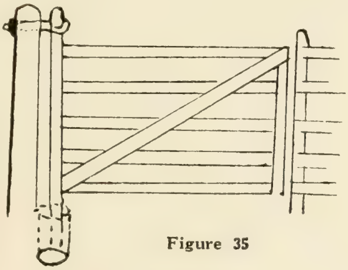


Figure 35

Farm gates can be hung without hinges by using scrap material available on most any farm. A wagon wheel hub sunk in the ground or a concrete block with a dished out place in the center serves as a bottom hinge. A large eye-bolt made from a 1-inch iron rod can be used for the upper hinge.

Ivy M. Howard.

Two Garden Helps

A tool useful in weeding onions and other closely growing vegetables, suggests Ivy M. Howard, of Oklahoma, may be made by bending an ordinary 10 or 12-inch file into a hoe-shaped implement, sharpening the point end of it, and fastening it to a hoe handle. This implement will go between the small plants without injuring them as does an ordinary hoe.

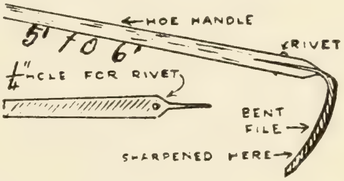


Figure 36

Charles L. Stewart of Alabama suggests a method of sticking pole beans by using pointed 3x4's or pine poles seven feet long. Beginning 14 or 15 inches from the point, drive in staples 4 or 5 inches apart. Put the stakes about 8 feet apart in the middles between double bean rows and string telephone wire through the staple eyelets. If stored in a dry place at end of season, the stakes and wire will last many years.

From Can Key to Needle

After you open a can of potted meat, or any other can requiring a key, don't throw away the key. You can make a good needle out of it. Just straighten the key and file into a round shape, filing the end to a fine point. The eye is already made, of course. After the proper size is obtained, sandpaper the key to insure perfect smoothness. Thus you have a dandy needle for sewing anything requiring heavy thread.

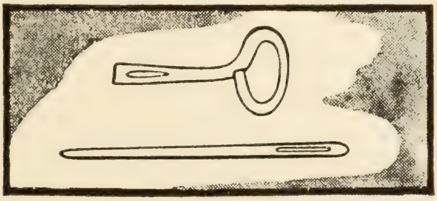


Figure 37

Joseph H. Bridges.

An Efficient Mole Trap

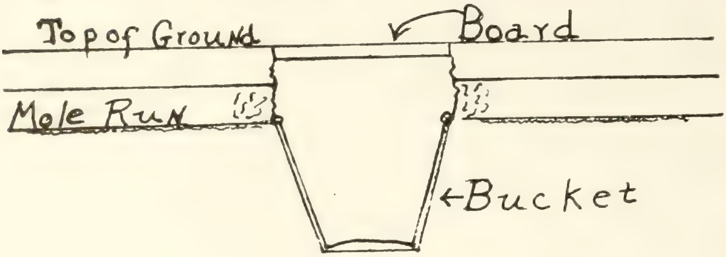


Figure 38

Find a run that is used regularly by the mole. Then with a post-hole digger dig a hole the size of a gallon bucket down through the run, so that when the bucket is placed in the hole the top of the bucket will be just below the tunnel. Plug each end of the tunnel with loose dirt. When the mole presses dirt out he will fall into the bucket and cannot climb out. Place a board over the hole.

Georgie W. Taylor,
Monroe County, Mississippi.

Gate Brace Prevents Sagging

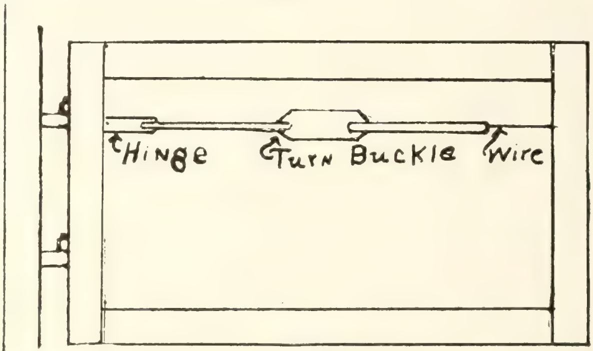


Figure 39

On the farm, gates that sag not only look bad, but they are sometimes very hard to open. One farmer whose home-made gates were always sagging, devised the brace shown in the accompanying illustration.

Put on the bottom hinge in the regular way, but instead of bolting the strap of the hinge to a slat, let it extend between the two pieces. Take a small turnbuckle, something like the kind used on screen doors, and put one end of it into an eye of the hinge. Attach a piece of wire to the other end of the gate. Fasten the loose end of the wire to the turnbuckle. Tighten until the gate swings clear of the ground.

M. L. Golden,
Panola County, Mississippi.

Pipe Wrench Substitute

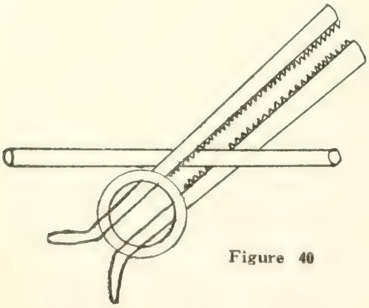


Figure 40

If you haven't a pipe wrench handy, make one with two old files and an ordinary washer, as shown in the drawing.

Hubert Gann,
Titus County, Texas.

Staple Puller

In taking down a wire fence pulling out the staples is usually a problem, but with an old mowing-machine guard and a claw hammer, it becomes a simple matter. Just drive the point of the guard behind the wire and under the staple as shown in the sketch.

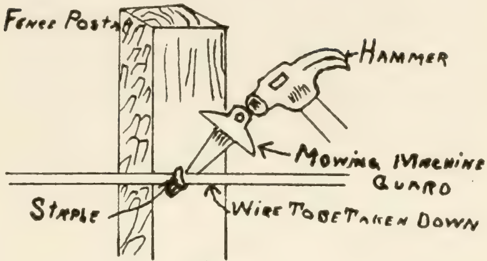


Figure 41

Myron Lynam,
Oktibbeha County, Mississippi.

THE FARM WORKSHOP

On many farms much time and money is wasted, many needed repairs, construction of farm equipment and home conveniences go undone because: (1) the necessary farm shop skills have not been acquired by many farmers and farm boys, (2) the failure to provide a definite farm workshop, and (3) the failure to secure needed tools and equipment.

It is recognized that many farmers and farm boys will have to do considerable practice to acquire the farm shop skills necessary to do farm shop work successfully. A farm workshop with needed tools and equipment would be an incentive for farmers and farm boys to do enough practice to develop the farm shop skills necessary to do farm shop work successfully.

Failure to provide a definite place or building for a workshop is one of the causes for needed repair jobs, and construction of farm equipment and home conveniences to go undone. The chances are that without a definite place to work many farmers and farm boys will waste many rainy and wintry days that might be profitably used doing needed repair work and building needed farm equipment and home conveniences.

In many cases a farm workshop may be had by building a shed on the side or back of the garage. The end of an implement shed or separate building might be utilized as a farm workshop. It is very important that the building provided be comfortable enough to permit working on cold wintry days.

The lack of tools and equipment on many farms causes much farm shop work to go undone. Many farmers may possess the necessary farm shop skills, and farm shop building, but have not the needed tools and equipment which causes farm shop work to go undone or it has to be hired done. Many farmers have enough tools on hand to start a farm workshop if they were kept together. "A place for everything and everything in its place" is a good motto in a farm shop. Tools scattered around the farm are seldom in good condition.

The following is a suggested list of tools and equipment that a farmer might secure in starting a farm workshop, which may be added to as needed:

I. Tools and Equipment to be Bought:

A. Woodworking

- 1 claw hammer
- 1 hand saw
- 1 hand rip saw
- 1 jack plane
- 1 steel square
- 1 set of auger bits
- 1 sweep brace
- 2 screw drivers (1 large and 1 small)
- 2 wood chisel—(1-½" 1-1")
- 1 wood spirit level
- 1 hand axe
- 1 drawing knife

B. Blacksmithing or Metal Working

- 1 hack saw
- 1 monkey wrench or Stillson
- 1 set of open end wrenches
- 1 chain drill
- 1 pair pliers
- 1 ball pein hammer (1½ pounds)
- 1 pair straight lip tongs
- 1 blower
- 1 blacksmith's vise

C. Leather Working

- 1 leather trimming knife
- 1 awl haft with set of assorted blades
- 1 paper leather sewing needles
- 1 collar awl
- 1 ball linen or flax thread
- 1 riveting machine

II. Tools and Equipment Home-Made:

- 1 anvil made from railroad steel
- 2 saw horses
- 1 leather stitching clamp
- 1 work table equipped with vise
- 1 saw filing clamp
- 1 forge hearth

Bulletin No. 338 February, 1940

Neutral
Versus
Acid Fertilizer

By

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Summary and Conclusions

All Mississippi soils are acid or are becoming acid because of leaching, crop removal, erosion, and the use of acid-forming fertilizers. Acid soils are deficient in lime, which is necessary for plant growth.

Since the use of acid-forming fertilizers increases soil acidity by taking out lime necessary for crop growth, an investigation on the value of neutral fertilizers was conducted by the Mississippi Experiment Station, in cooperation with the Tennessee Valley Authority, in which dolomitic limestone was added in sufficient quantities to replace the lime taken out of the soil by the fertilizers. These experiments were conducted over periods of 5 years, 4 years, and 3 years, in various sections of Mississippi and on many soils. Crop response to neutral fertilizers and to acid fertilizers was measured in pounds of seed cotton produced per acre.

An attempt was made in the majority of these experiments to correlate the study of neutral and acid fertilizers with the soil series, and with the pH level. Neither study was conclusively indicative, although soils with a pH reading above 7 consistently gave negative results, while soil series of a similar texture gave similar results.

There was a rather definite response trend on the basis of soil texture. Soils of a sandy texture responded favorably to the effect of lime in applications of fertilizer, whereas soils of a silt and clay texture responded but slightly or negatively to the lime used to neutralize acid fertilizers.

The average response to neutral fertilizers on soils of a sandy texture was an increased yield of 90 pounds of seed cotton per acre in the 5-year experiment, 104 pounds in the 4-year experiment, and 72 pounds in the 3-year period. The weighted average increase on soils of a sandy texture was an average increase of 88 pounds seed cotton per acre.

With seed cotton valued at 3c per pound, the increased production of 90 pounds increase per acre attributed to neutral fertilizers in the 5-year test on sandy soils represented an increased crop value of $2.70 per acre.

Dolomitic limestone was purchased in small quantities at a relatively high cost, and 100 pounds required to neutralize the 400-pound, acre-application, was 30c. This is a net increase of $2.40 per acre. With limestone valued at $3 per ton delivered in carlots, the acre cost of neutralizing acid fertilizer would be about 15c, and the net increase in value would be $2.55.

Approximately 300,000 tons of commercial fertilizers and fertilizer materials are purchased in Mississippi annually.

On the basis of these results, 1 ton of neutralized fertilizer applied on 5 acres of sandy textured soil would produce an increase over acid fertilizer of 450 pounds seed cotton.

Perhaps one-half the total annual tonnage of fertilizers purchased in Mississippi is utilized for cotton production on soils of a sandy texture.

NEUTRAL versus ACID FERTILIZER

By

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Commercial fertilizers have become a necessity for the most economical production of farm crops on most Mississippi soils. Especially is this true with reference to the upland soils which were deposited by processes other han over-flow water, and to all soils which are not replenished at intervals by additional deposits from over-flow water.

Soil specialists have identified and lassified some five hundred soil types in Mississippi, every one of which is different from the other in some respects. In exture these soils range from stiff, plastic clays to almost pure sands. The better oils usually come between the clays and ands, so the sandy loam soils are usually the most productive; however, many lay soils are very fertile, but for the lack of drainage or other characteristics, hey are sometimes unproductive.

Soils vary considerably in the kinds and amounts of plant nutrients they contain, and when planted to crops do not always respond alike to native or applied plant food, even though they may be of he same soil type, or closely related hereto. Fields that have been clean cultivated for many years without effective practices to prevent soil erosion and without the addition of plant foods will no oubt be more depleted of the necessary nutrients than soils that have been properly conserved.

The Problems of Soil Fertility

Since crops do not respond to fertilizers alike on the same type of soil, experiment tations find it an intricate and increasing problem to determine the proper kind and amount of fertilizer to be used to best dvantage on such large numbers of different soils.

Crops on most soils of the State respond to applied nitrogen, which no doubt proves there is a distinct deficiency of this plant nutrient. Many crops respond to applied phosphorus, potash, and lime. Lack of response to any one or any combination of these indicates a sufficient supply of such plant nutrients for some crops. The problem is to determine what soils are deficient in any one or more of these nutrients, and if crops will profitably respond to them when the deficient nutrients are added.

Statistical crops history shows long time low average yields of corn, oats, hay and other crops. This is probably due to the lack of plant nutrients in Southern soils. It seems sufficient proof that most Mississippi soils will produce profitably crops under prevailing prices of farm commodities only after fertilization, a portion of which may come from legumes plowed under and a portion of which may best be supplied by means of chemical fertilizers.

Long time experimental data, together with recent crop history, seem sufficient proof that when Mississippi soils are properly fertilized, profitable yields may be expected.

The Mississippi Experiment Station has conducted many experiments to determine the fertilizer requirements for certain widely prevalent soils and has secured some very valuable information. Nevertheless, in view of the wide range of soils and crops, it is felt that studies of fertilizer rates, sources, and methods of application are yet in their infancy. We believe, however, that available data are sufficient for the rough guidance of farmers in all sections of Mississippi, and that more exact information may be forthcoming from time to time.

All the foregoing applies to the commonly accepted deficient plant nutrients, namely nitrogen (N), phosphorus (P_2O_5), and potash (K_2O).

It was the purpose of this study to acquire information on the practical application and economic importance of another plant nutrient, namely, lime.

All soils in Mississippi are either acid or becoming acid. Soil acidity is due to a lack of bases. The chief base, from an acidity viewpoint, is calcium or "lime." However, magnesium, potassium, and sodium play an important part.

Mississippi Soils are Acid or Are Becoming Acid By Leaching, Erosion, Crop Removal, Acid Fertilizers

Acid soils become more acid, and alkaline soils become acid through the loss of basic materials, such as lime. These bases are lost from the soil in four ways: (1) leaching out by water passing through the soil, (2) erosion, (3) crop removal, and (4) the use of acid-forming fertilizers.

Each rain of sufficient quantity to cause water to pass through the soil removes the bases in solution at that time. These bases are comparatively soluble. Certain soil treatments hasten the loss of bases by leaching and thus hasten soil acidity. The turning under of large amounts of organic matter without the addition of any lime speeds up acid soil formation.

The loss of bases by erosion in Mississippi is enormous. In most soils of the State, the greatest concentration of bases is found in the surface soils. The organic matter and the fine clay contain a very high percentage of the bases as well as other essential plant nutrients. Especially during active erosion, these materials are easily "beat up" into a suspension and carried away in the run-off water.

All the base elements are found in plants, and are removed when crops are harvested. Three base elements (calcium, magnesium, and potassium) are essential to plant growth. When a crop is grown and plowed under, of course, no bases are removed by the plants. When the plants or any part of them are harvested, the bases in the harvested portions are a total loss to the soil.

The use of acid forming fertilizers contributes to soil acidity in direct proportion to the acidity of the fertilizer and the quantity that has been applied over a period of years. Not all commercial fertilizers are acid; but mixed fertilizers, such as 4-8-4 and other grades, are very commonly acid. Fertilizers contain nitrogen, phosphoric acid and potash in varying quantities and proportions, and while sources of the two last named are usually neutral, much of the material used to supply nitrogen is acid. By way of example, sulphate of ammonia is acid, urea is medium acid, calnitro and calcium nitrate are neutral, nitrate of soda is slightly basic, and cyanamid is basic. Sulphate of ammonia is an efficient source of nitrogen. It is usually economical in comparison with other nitrogen sources, and is probably used quite extensively in commercial fertilizers on that account. It is estimated that 3,000 pounds of agricultural lime (88 per cent pure) is required to neutralize the acidity of 2,000 pounds of sulphate of ammonia.

Determining Soil Acidity

There are several simple methods of determining soil acidity or alkalinity, most of which are accurate enough for average farm purposes. Many Smith-Hughes teachers and County Agricultural Agents are using a soil testing outfit known as "Soiltex," which consists of a small package of waxed paper, a tube of soiltex, a color chart and directions for use. It costs around $1.00, and may be bought for less in quantities.

Reading of the chart to measure soil acidity or alkalinity may be compared with the reading of an ordinary temperature thermometer. We use on the thermometer 32° as a freezing or neutral point; any degree above 32° is measured as rise in temperature, and any below 32° is measured as fall in temperature. The chart shows the number 7 as a dividing line or neutral point between acid and alkaline soils. Any number below 7 indicates the degree of acidity, while any number above 7 indicates the degree of alkalinity. To determine acidity or alkalinity, a small quantity of soil is treated with a liquid and the bases in the soil stain the liquid any one of a dozen or more colors; comparison of this colored liquid with a similar color on the color chart will show whether the soil is acid or alkaline, and the degree of alkalinity or acidity. This is the pH reading. Thus in this instance pH 7 is neutral, pH 7.6 is alkaline, pH 6.7 is slightly acid, and pH 4.7 is very acid. The chart shows approximately the amount of lime necessary to bring acid soils up to neutral.

Scant Increase in Liming Practices

Many agricultural workers for a long period of years have advocated the use of lime materials for increased agricultural production. The application of lime has never come into as general practice in this State as it has in other areas, due to several reasons. Crops produced outside the lime areas of Mississippi are tolerant of soil acidity. This is particularly true of cotton, our chief money crop, as well as the leading summer legumes—cowpeas, soybeans and lespedezas—and the leading winter legume—hairy vetch. Increased yields are normally secured from applications of lime; but

PRICES OF DOLOMITE AND LIMESTONE DELIVERED AT VARIOUS POINTS IN MISSISSIPPI

	Dolomite		Limestone	
	Birmingham, Alabama	Princeton, Kentucky	Nashville, Tennessee	St. Louis, Missouri
Holly Springs	2.79	2.21	2.21	2.25
New Albany	2.74	2.76	2.65	2.65
Starkville	2.60	2.65	2.65	2.13
Corinth	2.68	2.21	2.21	2.13
Brookhaven	3.07	2.76	2.76	2.80
Aberdeen	2.60	2.65	2.65	2.13
Hazlehurst	3.01	2.65	2.76	2.69
Magnolia	3.10	2.87	2.87	2.91
Grenada	2.79	2.32	2.32	2.36
Senatobia	3.07	2.27	2.21	2.31
Hernando	3.01	2.21	2.21	2.25
Calhoun City	2.79	2.82	2.82	2.26
Macon	2.68	2.85	2.76	2.13
Pascagoula	3.07	3.40	3.20	......
Booneville	2.74	2.65	2.49	2.13
Ashland	2.79	......	......	......
Columbus	2.50	2.85	2.82	2.13
Pontotoc	2.74	2.76	2.65	2.75
Ackerman	2.68	2.65	2.65	2.69
Fayette	3.10	2.87	3.20	2.91
Lexington	2.90	2.32	2.95	2.39
Laurel	2.79	3.01	3.01	3.06
Brandon	2.90	2.65	3.05	2.69
Hattiesburg	2.90	3.01	3.01	3.06

Add $1.00 per ton where dolomite is wanted in 100 pound paper bags.

increases of 50 to 100 pounds of seed cotton per acre, such as are shown in this report, do not show by mere casual observation, but only by thorough plat measurement and crop weights. For example, farmers accustomed to seeing crop production doubled by adequate fertilization can see little if any difference between a limed acre yielding 1,100 pounds of seed cotton and an unlimed acre yielding 1,025 pounds. Another reason is that lime has not been readily available in small quantities. This difficulty still exists, but lime may be purchased in carlot quantities, a minimum of 20 tons, at from $40 to $62.00 for the 20 tons, the exact cost depending on the location.

In the foregoing tabulation, prices are shown as of September, 1939, for ground and dolomitic limestone, including the freight charges, delivered to representative points in Mississippi.

Limestone supplies calcium, while dolomite supplies both calcium and magnesium. Many of our soils are deficient in magnesium, and on these soils dolomite is probably superior to limestone.

The prices of limestone and dolomite shown are, of course, subject to change, but indicate definitely the first cost of these materials. The quotations from companies listed do not represent all available sources, but are printed as representative of prevailing prices. These figures serve to indicate that by cooperative purchases or by dealer purchases in carlot quantities, lime may be easily and inexpensively secured.

Five-Year Experiment on Many Mississippi Soils To Determine Response of Cotton to Neutral Fertilizers

Many experiments have been conducted in several states to determine the efficiency of lime used in sufficient quantities to correct soil acidity. For reasons stated, and for other reasons, such experiments in Mississippi have given conflicting results.

This study conducted in cooperation with the Tennessee Valley Authority, involves an entirely different viewpoint. It seeks to determine the efficiency of lime in such a small quantity as merely to neutralize the otherwise acid-forming fertilizers, thus to check one important source of increasing soil acidity, and at the same time to supply lime needed as a crop nutrient.

Neutral Fertilizers Used in Test

Fertilizers used for most of these tests consisted of regular 4-8-4, which grade comprises approximately 80 per cent of all commercial mixed fertilizers purchased in Mississippi. The nitrogen in the fertilizer mixture used was derived from two sources: 90 per cent from sulphate of ammonia and 10 per cent from cottonseed meal; the P_2O_5 was derived from three different sources: 20 per cent superphosphate, 40 per cent triple superphosphate and 40 per cent dicalcium phosphate; and the K_2O was derived from 50 per cent muriate. Approximately 100 pounds of dolomitic limestone was added to each 400 pounds of the mixture to neutralize the acidity. The 4-8-4 mixture, without lime, was used on the check plats.

Since 1 ton of 4-8-4 fertilizer contains 80 pounds nitrogen, 160 pounds phosphoric acid, and 80 pounds of potash, the materials used in the experiment having 20 per cent superphosphate as the source of P_2O_5, comprised the following:

Nutrient and Source	Pounds
80 lbs. nitrogen from	
10% cottonseed meal (6.5%N.)	123
90% sulphate of ammonia (20.56%N.)	350

160 lbs. phosphorus (P_2O_5) from 20% superphosphate	800
80 lbs. potash (K_2O) from 50% muriate of potash	160
Dolomitic limestone	500
1 ton 4-8-4, neutralized	1933

Where 40 per cent triple superphosphate, or 40 per cent dicalcium phosphate was used as the source of P_2O_5, twice as much filler, or nearly 1000 pounds, would have been needed to even-weight a ton.

Many different materials are used in the mixing of complete fertilizers whether at home or in factories. The foregoing may be approximately representative of materials commonly used; and it is interesting to note that the quantity of "filler" needed to even-weight the ton was almost exactly the amount needed to neutralize acidity. The economic aspects of neutral fertilizers is to be discussed later, but in the meantime attention is directed to the fact that in event fertilizer is home-mixed, it will require the use of about 100 pounds of lime per acre, or 500 pounds per ton of fertilizers when sulphate of ammonia is used as the source of nitrogen; and in event the fertilizer is factory-mixed, the required 500 pounds of limestone would be supplied instead of an equal weight of sand or other inert, worthless, filler.

In a series of tests, direct comparisons were made of the neutral 4-8-4 mixtures described above, and of an acid 4-8-4 of identical materials and quantities (except that no limestone was added to neutralize acidity). Seventeen of these tests were conducted for a period of 5 years, 6 similar tests were conducted for a period of 4 years, and 6 similar tests were conducted for a period of 3 years.

Interpretation of Results

These tests were conducted in various sections of Mississippi and on many soils, under careful supervision to eliminate variable factors which might influence yield. These soils did not respond alike in all instances.

It was believed in the beginning that the relative degree of acidity, or pH reading, might determine crop response to lime application, or neutral fertilizers. Only in the broadest sense was such the case. There was a very limited relationship between the pH level and response to lime. While high-lime soils gave negative results, some slightly acid soils showed increases while others showed decreases, and some very acid soils followed the same variable response pattern.

There was a rather definite response trend on the basis of soil texture, however. Soils of a sandy texture responded most favorably to the effect of lime in application of neutral fertilizers, whereas soils of a silt and clay texture responded but slightly or negatively to lime used to neutralize acid fertilizers.

Outside of this clearly apparent trend, the interpretation of results is not easy. For example, there is no apparent reason why such a small application as 100 pounds of limestone per acre should decrease the yield on any soil.

On the other hand, these findings may be of the greatest importance. Approximately 75 per cent of the cultivated land in the hill section of Mississippi is of a sandy texture, and perhaps not less than 50 per cent of all commercial fertilizers used in Mississippi applied to cotton on these sandy soils.

Since the texture of any soil may be so easily determined by any interested farmer, it is thought advisable to present these results in more than ordinary detail in the hope that numerous farmers may apply the findings to their own conditions and conduct field trials on their own farms.

Hence, soils on which experiments were conducted are identified and briefly described, and experimental results shown in co-relationship with soils, topography, and texture.

Limestone to Neutralize Acid Fertilizers Profitably Used on Soils of Sandy Texture

Experiments on Upland Soils Common to the Coastal Plain Area

Ruston: Grayish-brown upland soils, with brownish-red and slightly mottled subsoils. Ruston soils are widely distributed in the hill section of Mississippi and are commonly accepted as the average in productiveness. They are almost level to steeply rolling, slightly acid to very acid, and are most commonly developed as a sandy loam type.

In a 5-year test of neutral vs. acid fertilizers on Ruston soil in Choctaw County, the average yield of seed cotton per acre from neutral fertilizers was 912 pounds, and from acid fertilizers, 745 pounds. This indicates an increase of 167 pounds seed cotton in favor of neutral fertilizer.

In another 5-year test made in Pearl River County, the average yield from neutral fertilizers was 882 pounds seed cotton, and from acid fertilizers, 612 pounds. This indicates an increase of 270 pounds seed cotton per acre.

Savannah: Gray to yellowish-brown upland soils with yellow subsoils, of somewhat limited distribution in Northeast Mississippi. In topography Savannah soils are level, gently rolling and rolling. They are slightly acid to very acid, and are most commonly developed in a sandy loam type.

In a 5-year test of neutral vs. acid fertilizers on Savannah soil in Lee County, the average yield from neutral fertilizers was 629 pounds seed cotton per acre, and from acid fertilizers, 547 pounds. These data show an increase of 82 pounds of seed cotton per acre in favor of neutral fertilizers.

In a 4-year test conducted in Tishomingo County, the average yield from neutral fertilizers was 537 pounds seed cotton per acre, and from acid fertilizers, 510 pounds. This indicates an increase of 27 pounds seed cotton per acre in favor of neutral fertilizers.

In a 3-year test on another farm in Tishomingo County, the average yield from neutral fertilizers was 936 pounds seed cotton, and from acid fertilizers, 864 pounds; an increase of 72 pounds seed cotton per acre.

In another test conducted for 3 years in Lowndes County, the average yield from neutral fertilizers was 797 pounds seed cotton, and from acid fertilizers, 734 pounds; an increase of 63 pounds seed cotton per acre.

Pheba: Grayish-brown upland soils with yellow subsoils, believed to be formed from the remains of wind-blown or loess material. Pheba soils are undulating to gently rolling, and are developed more or less over practically all of the hill section of Mississippi, sometimes in the silt loam type, but usually in the fine sandy loam type. They may be slightly acid to very acid.

In a 5-year test of neutral vs. acid fertilizers conducted on Pheba soil in Pontotoc County, the average yield of seed cotton from neutral fertilizers was 1,463 pounds per acre, and from acid fertilizers, 1,328 pounds; an increase of 135 pounds seed cotton per acre.

In a 5-year test conducted on Pheba soil in Lee County, the acre yield from neutral fertilizers was 1,002 pounds seed cotton, and from acid fertilizers, 956 pounds; an increase of 46 pounds seed cotton per acre.

In a 4-year test conducted on Pheba soil in Prentiss County, the average yield from neutral fertilizers was 1,138 pounds seed cotton and from acid fertilizers, 1,041; an increase of 97 pounds seed cotton per acre.

Atwood: Dark gray to brown upland soils, with red subsoils. Gently rolling to rather steep and hilly, they are found mostly in Northeast Mississippi. Atwood soils are slightly acid to very acid and are commonly developed in the sandy loam types.

In a 5-year test of neutral vs. acid fertilizers on Atwood soil in Lowndes County, the average yield from neutral fertilizers was 670 pounds seed cotton per acre, and from acid fertilizers, 612 pounds; an increase of 58 pounds seed cotton per acre.

Orangeburg: Gray to light red upland soils with deep and uniformly light red subsoils. Orangeburg soils are undulating to rolling in topography, are standard of the better soils of the Coastal Plain, moderately acid, and are commonly developed in the sandy loam type.

In a 5-year test of neutral vs. acid fertilizers conducted on Orangeburg soil in Neshoba County, the average yield from neutral fertilizers was 946 pounds seed cotton and from acid fertilizers, 910 pounds; an increase of 36 pounds seed cotton per acre.

Cuthbert: Light gray to grayish brown upland soils, with brownish red subsoils, of tough compact clay, and very susceptible on account of the subsoil to either wet or dry weather. Cuthbert soils are strongly acid, and are widely distributed over the state. They are commonly developed in the sandy loam type.

In a 5-year test of neutral vs. acid fertilizers conducted on Cuthbert soil in Webster County, the average yield from neutral fertilizers was 518 pounds seed cotton, and from acid fertilizers, 437 pounds; an increase of 81 pounds seed cotton per acre.

Lufkin: Gray to brown "Flatwoods" upland soils with gray to yellowish brown subsoil of plastic, sticky clay. The only upland soil series characteristic of the flatwoods area, Lufkin soils are extremely acid, and are commonly developed in both the sandy loam and silt clay types. The sandy type is usually selected for cultivation when available.

In a 3-year test of neutral vs. acid fertilizers conducted on Lufkin soil of sandy texture in Chickasaw County, the average yield from neutral fertilizers was 807 pounds seed cotton, and from acid fertilizers 657 pounds; an increase of 150 pounds seed cotton per acre.

Kirvin: Gray to brown upland soils with brick-red compact subsoils. Somewhat similar in structure to Cuthbert, Kirvin soils are gently rolling to steep and hilly, acid to very acid, and are commonly of the sandy loam type.

In a four-year test of neutral vs. acid fertilizers on Kirvin soil in Neshoba County, the average yield from neutral fertilizers was 753 pounds seed cotton, and from acid fertilizers, 622 pounds; an increase of 131 pounds seed cotton per acre.

Experiments on Terrace Soils Common to the Coastal Plain Area

Kalmia: Gray to pale yellow terrace soils, with yellow subsoils. Level to gently rolling, with drainage sometimes required, and about equal to Ruston in productivity. One of the most widely distributed soils of the Coastal Plain, slightly acid to very acid. Commonly developed in the sandy loam type.

In the 5-year test of neutral vs. acid fertilizers conducted on Kalmia soil in Monroe County, the average yield from neutral fertilizers was 836 pounds seed cotton, and from acid fertilizers, 695 pounds; an increase of 141 pounds seed cotton per acre.

In a similar 5-year test in Lee County, the average yield of seed cotton from neutral fertilizers was 784 pounds, and from acid fertilizers, 793 pounds; a decrease of 9 pounds seed cotton per acre.

In a 4-year test of neutral vs. acid

fertilizers, conducted on Kalmia soil in Itawamba County, the average yield from neutral fertilizers was 757 pounds seed cotton, and from acid fertilizers, 656 pounds; an increase of 101 pounds seed cotton per acre.

Cahaba: Gray to brownish-colored terrace soils, with reddish-brown subsoils, which with Kalmia, may be roughly considered as average of terrace soils of the hill section. Cahaba soils are widely distributed over the state, range from almost level to slightly rolling, and are commonly developed in the sandy loam types. They are slightly acid to very acid.

In a 5-year test of neutral vs. acid fertilizers conducted on Cahaba soil in Newton County, the average yield from neutral fertilizers was 664 pounds seed cotton, and from acid fertilizers, 687 ponuds; a decrease of 23 pounds seed cotton per acre.

Myatt: Dark gray terrace soils with light-colored subsoils, often called "pen-oak" land. Myatt is found in all parts of Mississippi except the Delta and brown loam section, and on account of the poor drainage and extreme acidity, it is commonly used for pasture, rather than for crop production. It is commonly developed in the sandy loam type.

In a 4-year test of neutral vs. acid fertilizers conducted on Myatt soil in Clay County, the average yield from neutral fertilizers was 612 pounds seed cotton, and from acid fertilizers, 448 pounds; an increase of 164 pounds seed cotton per acre.

Experiments on Bottom Soils Common to the Coastal Plain Area

Ocklocknee: Brown bottom soil with gray and yellow mottled subsoil. The most generally distributed of any of the bottom soils in the Coastal Plain Province, and when properly drained, is most desirable though not so productive naturally as the less widely distributed Vicksburg, Trinity, Catalpa, and Sarpy bottom soils. While commonly developed in both clay and sandy loam types, cultivated Ocklocknee is usually of a sandy loam type.

In a 3-year test of neutral vs. acid fertilizers on Ocklocknee soil in Oktibbeha County, the average yield from neutral fertilizers was 925 pounds seed cotton, and from acid fertilizers, 887 pounds; an increase of 38 pounds seed cotton per acre.

In a 3-year test in Marshall County, the average yield from neutral fertilizers was 655 pounds seed cotton, and from acid fertilizers, 540 pounds; an increase of 115 pounds seed cotton per acre.

Experiments on Upland Soils of the Prairie and Brown Loam Areas

Houston: Dark brown to grayish black upland soils with dark gray, brownish-yellow, or greenish-colored subsoils. Houston soils are commonly known as the "black prairie." They are developed on undulating to gently rolling topography, are moderately productive of field crops, and are superior for grasses and clover. Houston is a high-lime soil of the clay type.

Sumpter: Light brown to grayish-yellow, high lime upland soils, with greenish-yellow subsoils. Sumpter is similar in many respects to Houston, also of the black prairie area, and may be an eroded phase of Houston.

In a 5-year test of neutral vs. acid fertilizers conducted on Houston and Sumpter clay soils in Clay County, the average yield from neutral fertilizers was 602 pounds seed cotton, and from acid fertilizers, 619 pounds; a decrease of 17 pounds seed cotton per acre.

Oktibbeha: Brownish-red upland soil with yellow mottled subsoil. Locally known as "Red Prairie" or "Post-Oak," it is found mainly in close proximity to the black prairie soil; and while closely associated with the Selma Chalk or lime formation, Oktibbeha soils are acid. They are commonly developed in the clay types.

In a 5-year test of neutral vs. acid fertilizers conducted on Oktibbeha clay soil of Lowndes County, the average yield from neutral fertilizers was 510 pounds seed cotton, and from acid fertilizers, 498 pounds; an increase of 12 pounds seed cotton per acre.

Grenada: Light brown upland soils of wind-blown origin, with yellowish-brown subsoils. This series is closely associated with Lexington and Memphis, and differs chiefly in that its loessial or wind-blown material is thicker than that of Lexington and thinner than that of Memphis. The topography is gently rolling to steepy rolling. Grenada, and other soils of the brown loam region, are slightly acid, and as a general rule are developed only in the silt loam types.

In a 5-year test conducted on Grenada silt loam in Marshall County, the average yield from neutral fertilizers was 1,353 pounds seed cotton, and from acid fertilizers, 1,319 pounds; an increase of 34 pounds seed cotton per acre.

Experiments on Terrace Soils Common to The Brown Loam Area

Lintonia: Light brown to gray terrace soils, with yellow subsoils. The four terrace soils of the brown loam region are roughly classified in desirability somewhat on the basis of the depth of the wind-blown materials. In Richland this material is 3 to 5 feet, in Lintonia it is 2 to 3 feet deep, in Olivier it is 1 to 3 feet, in Calhoun 6 to 8 inches, and in Carroll the normally sub-surface material is on the surface. All brown loam terrace soils are commonly developed in the silt loam types.

In a five-year test of neutral vs. acid fertilizers on Lintonia soil in Alcorn County, the average yield from neutral fertilizers was 1,325 pounds seed cotton and from acid fertilizers, 1,375 pounds; a decrease of 50 pounds seed cotton per acre.

Olivier: Brownish-gray terrace soils of wind-blown origin with yellow subsoils of Coastal Plains material. Topography is level to undulating, and Olivier soils are usually found on lower terraces than Lintonia.

In a 5-year test of neutral vs. acid fertilizers conducted on Olivier soil in Alcorn County, the average yield from neutral fertilizers was 1,277 pounds seed cotton, and from acid fertilizers, 1,322 pounds seed cotton; average decrease of 45 pounds seed cotton per acre.

In a similar 5-year test conducted in Hinds County, the average yield from neutral fertilizers was 1,122 pounds seed cotton, and from acid fertilizers, 1,183 pounds; an average decrease of 61 pounds seed cotton per acre.

Experiments on Bottom Soils of the Prairie Area

Trinity: Dark gray to black alluvial bottom soil with dark colored subsoils. Trinity soils are found in the first bottoms of streams rising in or flowing through the black prairie region. They are fertile and with adequate drainage are highly productive. They are high lime soils, and commonly developed in the silty clay or clay types. Trinity soils are associated with Bell, often in same bottom, and usually occupy the first bottom, and are subject to more or less frequent overflow, whereas Bell is a terrace soil, has a higher elevation and is normally above overflow.

In a 4-year test of neutral vs. acid fertilizers conducted on Trinity soil in Itawamba County, the average yield due to neutral fertilizers was 786 pounds seed cotton, and to acid fertilizers, 844 pounds; an average decrease of 58 pounds seed cotton per acre.

90 Pounds More Seed Cotton Per Acre, 450 Pounds Per Ton From Neutral Fertilizer on Soils of a Sandy Texture

Experimental information is given stability only when the data represent a sufficient number of years to equalize various factors, including unavoidable minor differences in soils and plat treatment, stands, and in rainfall and other environmental factors which affect yield. Five-year results seem about the minimum with which to equalize the differences, though results for lesser periods are of value as supporting data, and as a means of rough guidance until more complete information is secured.

For the above reasons, results of the work with acid and neutral fertilizers are presented separately by periods. Table 1 shows the results of work conducted 5 years; table 2 shows the results of work conducted 4 years; and table 3 shows the results of work conducted 3 years.

TABLE 1—NEUTRAL FERTILIZERS VS. ACID FERTILIZERS, YIELD IN POUNDS OF SEED COTTON PER ACRE, SOILS OF A SANDY TEXTURE

Name of Cooperator	County	Soil Series	Years	Yield Neutral Fertilizers	Yield Acid Fertilizers	Increase	pH
T. A. Coleman Weir, Miss.	Choctaw	Ruston	1935-39	912	745	167	6.1
H. Q. Brooks Smithville, Miss.	Monroe	Kalmia	1935-39	836	695	141	5.5
J. R. Vaughn Shannon, Miss.	Lee	Savanah	1935-39	629	547	82	6.2
H. L. Wilder Beldon, Miss.	Pontotoc	Pheba	1935-39	1463	1328	135	6.7
W. N. Hutchinson Caledonia, Miss.	Lowndes	Atwood	1935-39	670	612	58	6.0
South Miss. Exp. Sta. Poplarville, Miss.	Pearl River	Ruston	1935-39	882	612	270	5.7
W. R. Walker Collinsville, Miss.	Newton	Cahaba	1935-39	664	687	—23	6.3
Pascol Watkins Dixon, Miss.	Neshoba	Orangeburg	1935-39	946	910	36	5.7
T. L. Adams Tom Nolan, Miss.	Webster	Cuthbert	1935-39	518	437	81	5.0
Charles Buchannon Sherman, Miss.	Lee	Pheba	1935-39	1002	956	46	5.4
L. L. Hardy Guntown, Miss.	Lee	Kalmia	1935-39	784	793	—9	5.4
Average 11 tests			1935-39	846	756	90	.....
Soils of Silt and Clay Texture							
West Point Exp. Sta. West Point, Miss.	Clay	Houston & Sumpter	1935-39	602	619	—17	7.5
Holly Springs Exp. Sta. Holly Springs, Miss.	Marshall	Grenada	1935-39	1353	1319	34	6.9
J. E. Gilliam Columbus, Miss.	Lowndes	Oktibbeha	1935-39	510	498	12	5.2
Hillie Bridges Corinth, Miss.	Alcorn	Olivier	1935-39	1277	1322	—45	5.4
W. E. Monroe Rienzi, Miss.	Alcorn	Lintonia	1935-39	1325	1375	—39	5.5
Raymond Exp. Sta. Raymond, Miss.	Hinds	Olivier	1935-39	1122	1183	—61	5.3
Average 6 tests			1935-39	1031	1053	—22	.....

Summary, 5-Year Test Period

Data in table 1 show average results for 17 tests conducted during the 5-year period 1935-39, on 14 soil series located in 14 counties, and grouped into soils of sandy texture and of silt and clay texture.

On eleven soils of sandy texture these data show increases ranging from 36 pounds to 270 pounds of seed cotton per acre in 9 tests, and decreases of 9 pounds and 23 pounds respectively on 2 tests.

The average response to neutral fertilizers was an increase of 90 pounds of seed cotton per acre for the 11 tests conducted on sandy soils, increases and decreases considered.

Six tests were conducted on silt and clay textured soils. Four of these showed decreases ranging from 17 pounds to 61 pounds seed cotton per acre, and 2 showed increases of 12 pounds and 34 pounds of seed cotton per acre, respectively.

The average response of the 6 tests conducted on silt and clay textured soils was an average decrease of 22 pounds seed cotton per acre.

The sandy textured soils ranged from pH 5.0 to pH 6.7, while the silt and clay textured soils ranged from pH 5.2 to pH 7.5.

TABLE 2—NEUTRAL FERTILIZERS VS. ACID FERTILIZERS, YIELD IN POUNDS OF SEED COTTON PER ACRE, SOILS OF A SANDY TEXTURE

Name of Cooperator	County	Soil Series	Years	Yield Neutral Fertilizers	Yield Acid Fertilizers	Increase	pH
L. C. Latimer Philadelphia, Miss.	Neshoba	Kirvin	1935-38	753	622	131	5.8
T. H. Thompson Montpelier, Miss.	Clay	Myatt	1935-38	612	448	164	5.2
Elza Hankins Fulton, Miss.	Itawamba	Kalmia	1935-38	757	656	101	5.0
L. E. Robinson Tishomingo, Miss.	Tishomingo	Savanah	1935-38	537	510	27	4.6
G. C. Huffman Wheeler, Miss.	Prentiss	Pheba	1935-38	1138	1041	97	5.7
Average 5 tests				759	655	104	.....
Soils of a Clay Texture							
T. C. Deane Dorsey, Miss.	Itawamba	Trinity	1935-38	786	844	—58	7.8

Summary, 4-Year Test Period

Data in table 2 show average results for 6 experiments conducted for the 4-year period 1935-1938, on 6 soil series, located in 5 Mississippi counties.

As in the preceding table 1, soils of a sandy texture responded with increased crop yields to the use of neutral fertilizers when compared to acid fertilizers. These data show increases ranging from 27 pounds to 164 pounds of seed cotton per acre on 5 tests when conducted on soils of a sandy texture. No decrease was shown by any sandy textured soil in this test.

The average response to the use of neutral fertilizers as compared with acid fertilizers was an average increase of 104 pounds of seed cotton per acre for the 5 experiments. These soils ranged from pH 4.6 to pH 5.8.

One experiment conducted during this 4-year period on a clay textured soil with a pH of 7.8 showed a decrease of 5.8 pounds seed cotton per acre.

TABLE 3—NEUTRAL FERTILIZERS VS. ACID FERTILIZERS. YIELD IN POUNDS OF SEED COTTON PER ACRE. SOILS OF A SANDY TEXTURE

Name of Cooperator	County	Soil Series	Years	Yield Neutral Fertilizers	Yield Acid Fertilizers	Increase	pH
Maben School Maben, Miss.	Oktibbeha	Ocklocknee	1935-37	925	887	88	4.8
J. M. Westmoreland Houlka, Miss.	Chickasaw	Lufkin	1935-37	807	657	150	4.9
T. H. Dean Belmont, Miss.	Tishomingo	Savanah	1935-37	936	864	72	4.7
Tom Andrews Caledonia, Miss.	Lowndes	Savanah	1935-37	797	734	63	5.1
D. L. Greer Potts Camp, Miss.	Marshall	Ocklocknee	1935-37	655	540	115	*
J. C. Boggan Amory, Miss.	Monroe	Pheba	1935-37	955	963	—8	5.0
Average for 6 tests			....	846	774	72	.....

*pH not determined.

Summary, 3-Year Test Period

Data in table 3 show average results for 6 experiments conducted during the 3-year period 1935-1937 on 4 soil series located in 6 Mississippi counties. All of these experiments were conducted on soils of a sandy texture.

The response to neutral fertilizers as compared with acid fertilizer was an average increase ranging from 38 pounds to 150 pounds of seed cotton per acre on 5 experiments, and a decrease of 8 pounds per acre for 1 experiment. These soils ranged from pH 4.7 to pH 5.1.

The average response to neutral fertilizers over acid fertilizers during the 3-year period in the 6 experiments on sandy textured soils was an average net increase of 72 pounds seed cotton per acre.

Evaluation

An attempt was made in the majority of these experiments to correlate the study of neutral vs. acid fertilizers with the soil series and pH level. It will be noted in the foregoing tables that the pH reading is by no means conclusively indicative. It may be of some significance, however, that the soils of silt and clay texture are consistently higher in pH readings. In no case is an increase in yield shown on soils with the pH reading above 7. In most cases when the pH is below 7, increased yields are shown but not systematically with the pH reading.

The increased production of cotton on sandy textured soils by reason of neutral fertilizers is at first thought disappointingly low. The importance of such an increase lies in the fact that it is almost all clear profit.

It has been shown that the net response to neutralizing acid fertilizer on soils of a sandy texture was an average increased yield of 90 pounds of cotton in the 5-year experiment, 104 pounds in the 4-year period, and 72 pounds in the 3-year period. The weighted average for the 3 periods was an average increase of 88 pounds seed cotton per acre.

Dolomitic limestone used in these experiments was necessarily purchased in small quantities and at a correspondingly high price. The actual small-quantity cost of 100 pounds of dolomitic limestone required to neutralize the acidity in 400 pounds of fertilizers based on home-mixed goods was about 30c.

With seed cotton valued at 3c per pound, the average of 90 pounds increase per acre, attributable to a neutral fertilizer in the 5-year test on sandy soils as shown in table 1, equals an increased crop value of $2.70 per acre.

This is a net increase over production costs of $2.40 per acre, and represents a return of 900 per cent on the small investment of 30c per acre. By comparison, it might be stated that information has been compiled showing average returns under good farming of approximately 150 per cent profit on the normal fertilizer investment.

Data has been cited showing that limestone is available in carlot quantities at a cost approximately $3.00 per ton delivered in Mississippi. On this basis, the cost of neutralizing a 400-pound acre-application of 4-8-4 fertilizer would be about 15c. The return on the 15c invested would be about $2.55, or about 1800 per cent on the investment in lime.

In the cited formula by which the fertilizers used in these experiments were home-mixed, it was shown that while using standard materials as sources of nitrogen, phosphoric acid and potash, approximately 500 pounds of filler would be required to produce a 4-8-4 mixture. Numerous materials are used by fertilizer factories, and the percentage of filler is necessarily determined by the materials used. The authors could not determine the amount of filler used in any mixed fertilizer until acquainted with the materials used in it. It is to be understood that the current use of filler is a perfectly honest and perhaps a necessary practice in the standardization of fertilizer formulae. In any event, fertilizers are sold on the basis of plant food content guaranteed by manufacturers, and state law sees to it that the guarantee is fulfilled.

The point of importance is that sand or other inert or worthless filler now used as such filler must be purchased, loaded, often shipped and handled; all of which involve monetary costs. It is entirely possible that worthless filler costs half as much as does limestone delivered in carload lots. On this basis, 500 pounds of limestone sufficient to neutralize 1 ton of otherwise acid forming fertilizer, would involve a net added cost of from 35c cents to 50 cents per ton of fertilizer.

Since applications of 4-8-4 neutral fertilizer were uniformly made at the rate of 500 pounds per acre, average increased yields per acre may be interpreted in terms of increased yields per ton of neutralized fertilizers.

On the basis of results cited in table 1, 1 ton of neutralized fertilizer applied on 5 acres of sandy textured soil would yield an increase over acid fertilizers of 450 pounds seed cotton.

The value of such an increase in cotton yield from 1 ton of neutral fertilizer, at 3c per pound, totals $13.50.

It is interesting to note that the foregoing value of increased cotton yields secured merely by neutralizing otherwise acid forming fertilizers is equal to approximately one-half the entire cost of 1 ton of neutral fertilizer.

Purchases of fertilizer and fertilizer material by Mississippi farmers vary considerably in tonnage from year to year. During the past 4 years purchases have averaged about 300,000 tons annually. Approximately half the total tonnage is mixed or complete fertilizer. Of the approximate half remaining, much material is used as a side or top dressing and an undetermined portion is used for home mixing. Of the complete fertilizer used for cotton in the hill section of Mississippi, by far the greater part is used on soils of sandy texture.

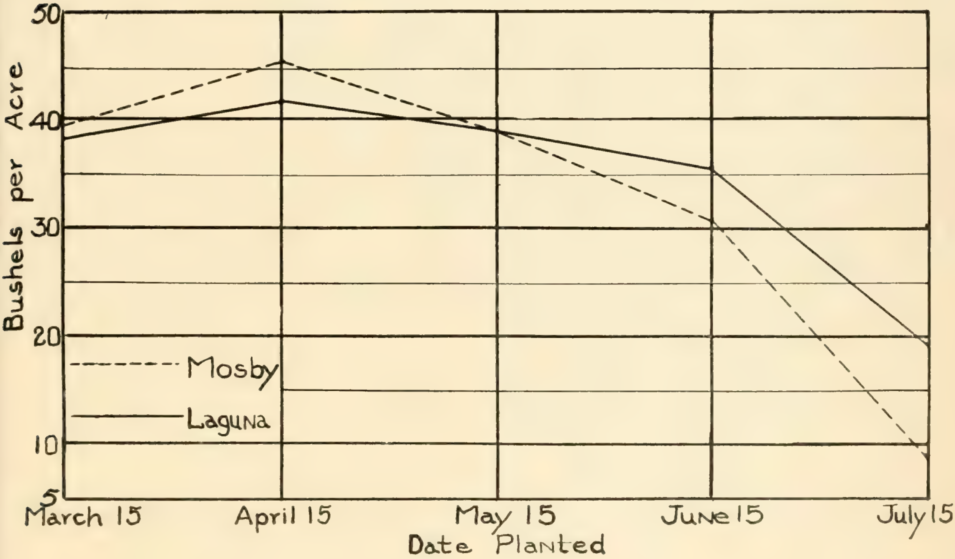
Thus, on the basis of results of these experiments, it appears possible to add $1,000,000 to $2,000,000 annually to the net income of Mississippi farmers merely by adding or substituting for filler, enough limestone to neutralize all acid-forming fertilizers.

Bulletin No. 339 March, 1940

Corn Varieties In Mississippi

By

C. R. OWEN, Assistant Agronomist



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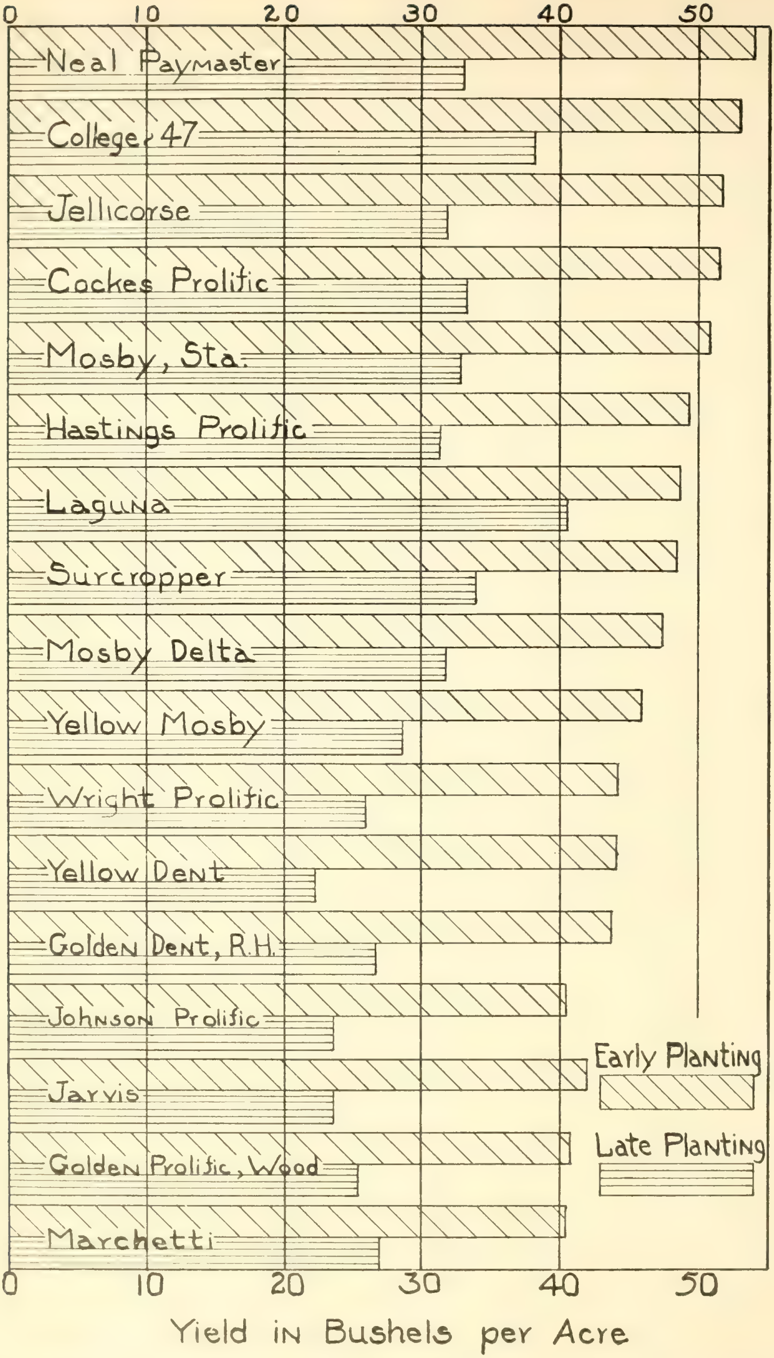

FIGURE 1—COMMONLY GROWN CORN VARIETIES IN MISSISSIPPI—EARLY AND LATE PLANTING

CORN VARIETIES IN MISSISSIPPI

By C. R. OWEN, Assistant Agronomist

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Corn ranks second only to cotton in importance in Mississippi. The average acreage planted annually during the past ten years was nearly two and one-half million acres. The average acre yield during the same period was only slightly less than 15 bushels. Because of this low yield, at the present price or at the average price of corn, there is but a slight margin between the cost of production and the value of the harvested product. Under the circumstances and under the prevailing agricultural situation, steps should be taken to improve the acre yield in corn production.

There is no crop that gives better response to improved conditions than corn. If rainfall distribution were more certain and the fertility level of the soils were at the proper state, there would be no serious corn production problems present. However, with a serious limitation upon soil fertility and with uncertain rainfall distribution it remains that amends to the fertility is a speculative investment. Probably the clearest avenue of approach to improving the situation is to plant the corn acres to seed of varieties which have been tested and found to be able to make the most of the unfavorable conditions and at the same time be able to give compensating yields whenever seasons are more favorable.

Publications of the results of corn experiments have been issued by this Station from time to time. These include Bulletin 170, 1915; Bulletin 197, 1921; Circular 47, 1923; and Bulletin 236, 1926. It is proper at this time to quote the statement from Bulletin 197, now out of print: "In 1919 the average yield was 15 bushels and in 1918, 17 bushels. Yields of more than a hundred bushels per acre have been made in the state in a number of instances. The average should be raised, and could be by the use of better adapted varieties, better tillage, and especially by improving the fertility of the soil." The same recommendations are offered today; and since the acre yield in 1938 was only 16.0 bushels, it appears that either they may not hold true or they have been put into practice only to a very limited extent.

In a survey made by Mr. E. L. Langford for the Bureau of Agricultural Economics, U. S. Department of Agriculture, of the quantity of food and feed needed for consumption on the farms of Mississippi, it is estimated that 914,295 additional acres of corn are needed for an adequate supply.

It is therefore clear then that overproduction of corn is not a problem in this state. If this shortage should be overcome only by increasing the acreage planted, chances are the situation would not be improved. The cost of land preparation, planting and cultivating an acre producing 15 bushels or less is practically the same as that on an acre producing 30 bushels or more.

During the past few years it has been the practice of this Station to publish the results of the year's experiments in "Information Sheets." Here an effort is made to combine this information for a period of 10 years.

Methods of Conducting Tests

Seed of from 20 to 25 varieties which are prominent in the South have been procured from year to year and planted to uniform tests at the Central Station and at each of the branch experiment stations in the state. The date of planting, width of row, space within rows, and fertilization have been that thought to be best suited to the particular area in which the station is located, but uniform at each station for all varieties. The test plats have been single rows, about 125 feet in length, with from four to eight replications. Each plat was harvested separately, the corn shelled, and the yield per acre in bushels of grain calculated from the average of each variety.

The yields for each year are presented in tabular form for each station. Since not all varieties are present over the entire period, some adjustment is necessary in order to show them on a comparable basis. This is attempted by rating each variety on a percentage rating basis. The check value is the average of all varieties on test every year. To arrive at the percentage rating, the actual average of each variety was divided by the average of the checks each year that that variety was on test. The comparative yield is the product of the 10-year average for all checks and the percentage rating. For example, if a variety were on test three years during which the yields were high, the percentage rating would give a comparison of it with the standard varieties grown the same seasons. Whereas, an actual average obtained by summing the yields for each year it was on test and dividing by the number of years, would tend to emphasize the years' yield during which it was on test and give no basis of comparing it with other varieties grown during other seasons. Some varieties were tried during the test and dropped because of their definite inferiority to the others. Others were dropped because orders for the seed failed to be filled. As those were discarded for the various reasons, it was necessary to make additions to the test with new varieties.

Experimental Error Present

There may be a tendency on the part of many readers to emphasize small differences, say one bushel, as a real difference. This tendency is an honest one, but it should not be practiced. Tests conducted at this and other stations indicate that as high as from 3, 5, or even more bushels per acre may be safely allowed for errors in experimentation. Hence if two varieties differ only 3 bushels per acre, there may be actually no difference between them in yielding ability. Many precautions have been taken to keep the error to a minimum in these experiments.

10 Year Results of Corn Variety Tests at State College, Holly Springs, Stoneville, Raymond, Natchez, Poplarville

State College is located in Oktibbeha County on the limestone area of the northeastern part of the state. The soils on which the corn variety test was planted is known as Ocklocknee silt loam.

It has been the practice at State College during the past 10 years to make an early and late planting with the varieties to be planted. The early planting has been made as near April 1 as was practical. The late planting was made during the first part of June. The results of both plantings are given in tables 1-a and 1-b Only the early test will be considered here but a comparison of the two plantings will be taken up later.

In table 1-a there is a difference of more than 20 bushels per acre between the highest and lowest yielding varieties. Neal's Paymaster, Jellicorse, Cockes Prolific, Mosby Station, and Hastings Prolific are the high ranking varieties. College Hybrid 47 ranks well among these. Highest yielding among yellow varieties, but under the yields of the foregoing white varieties, are Yellow Mosby, and Russell-Heckle's Golden Dent. Ferguson's Yellow Dent gives equally as good yields but is not resistant to the grain rots. The amount of unsound corn present in this

TABLE 1-A—THE AVERAGE OF EARLY TEST OF CORN VARIETIES AT STATE COLLEGE

	Yield in Bushels per Acre											%	Comp.
	1928	1929	1930	1932	1933	1934	1935	1936	1937	1938	Av.	Rating*	Yield
Neal's Paymaster	46.2	62.9	51.0	64.2	39.6	58.3	51.5	50.2	51.4	64.7	54.0	109.8	54.0
College Hybrid 47	44.3	59.4	47.9	69.8	48.7	59.4	46.5	47.4	50.0	56.4	53.0	107.7	53.0
Jellicorse	......	......	46.6	71.4	48.3	59.2	48.9	46.7	44.8	53.7	52.4	105.9	52.1
Cockes Pro. Sta.	45.8	61.5	47.5	69.6	44.6	56.7	44.6	44.2	46.7	57.2	51.8	105.3	51.8
Mosby, Station	45.3	57.3	40.9	69.1	45.3	55.9	45.5	43.4	50.1	55.7	50.8	103.3	50.8
Hastings Prolific	42.3	60.4	31.4	68.4	51.2	60.6	43.0	41.7	42.5	51.8	49.3	100.2	49.3
Laguna	40.6	53.1	40.6	62.6	44.2	56.0	44.1	50.1	45.3	50.2	48.7	99.0	48.7
Surcropper	......	......	......	......	......	......	48.3	47.3	40.0	51.5	46.8	98.5	48.5
Mosby, Delta	30.9	56.8	35.1	69.0	44.0	57.5	47.9	41.9	40.7	48.0	47.2	95.9	47.2
Mosby, Woodruff	......	......	......	63.3	41.8	54.4	40.5	......	......	......	50.0	95.1	46.8
Yellow Mosby	......	......	......	......	......	......	......	45.9	38.5	49.2	44.5	93.1	45.8
Wright's Prolific	......	......	......	......	......	......	44.1	39.5	40.7	45.9	42.5	89.5	44.0
Ferguson's Y. D.	32.1	41.3	41.7	51.8	38.9	54.0	49.9	42.6	35.7	52.3	44.0	89.4	44.0
Russell-Heckle's Golden Dent	39.7	43.8	40.7	50.9	38.6	48.6	43.5	42.1	40.1	48.8	43.7	88.8	43.7
Whatley's Prolific	......	......	......	......	......	......	......	......	......	47.5	47.5	88.1	43.3
Yellow Surcropper	......	......	......	......	......	......	......	......	......	46.8	46.8	86.8	42.7
Thompson's Pro.	......	......	......	......	......	......	......	35.3	40.9	......	38.1	85.0	41.8
Jarvis	......	......	35.6	50.6	33.5	44.6	44.2	35.5	37.6	46.2	41.0	82.8	40.7
Wood's Gol. Pro.	......	......	......	52.5	33.7	51.2	43.7	35.3	35.7	38.6	41.5	82.0	40.3
Johnson's Prolific	......	......	......	......	......	......	39.1	32.0	39.6	......	36.9	81.5	40.1
Wood's Cockes Pro.	......	......	......	55.1	33.0	44.2	......	......	......	......	44.1	80.6	39.7
Marchetti	......	......	......	......	33.7	40.3	38.2	35.0	35.0	39.5	37.0	76.6	37.7
Piggot's Red Cob	......	......	......	......	......	......	......	......	32.8	37.0	34.9	70.6	34.7
Yellow Creole	......	......	......	......	......	40.1	25.0	......	......	......	32.5	63.4	31.2
Average for 9 check variety	40.8	55.2	41.9	63.9	43.9	56.3	46.3	44.8	44.8	53.9	49.2	......	......

The check varities are: Neal's Paymaster, College Hybrid 47, Cockes Prolific, Mosby Station, Hastings Prolific, Laguna, Mosby Delta, Ferguson's Yellow Dent, Russell-Heckle's Golden Dent.

TABLE 1-B—THE AVERAGE FOR THE LATE TEST OF CORN VARIETIES AT STATE COLLEGE

	Yield in Bushels Per Acre											%	Comp.
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Ave.	Rating*	Yield
Laguna	48.0	11.4	32.5	53.9	36.1	37.8	50.0	35.7	48.1	50.5	40.4	125.5	40.4
College Hybrid 47	44.5	7.8	30.2	56.9	39.7	23.3	49.9	32.4	48.9	46.9	38.0	118.0	38.0
Surcropper	......	......	......	......	......	......	......	34.9	46.8	35.2	39.0	105.4	33.9
Cockes Pro. Sta.	43.9	4.2	22.9	50.9	28.5	24.5	45.5	27.8	42.0	42.2	33.2	103.1	33.2
Neal's Paymaster	39.9	3.1	18.8	55.3	27.0	24.1	43.9	29.2	45.7	42.9	33.0	102.5	33.0
Mosby Station	49.7	1.8	23.4	47.2	27.4	23.2	41.9	24.7	41.2	48.0	32.8	101.9	32.8
Jellicorse	......	......	22.4	47.0	26.7	21.5	44.3	27.8	44.5	37.3	33.9	98.3	31.7
Mosby Delta	......	2.9	22.9	46.6	27.4	25.3	41.7	30.5	39.7	36.7	30.4	97.7	31.5
Hastings Pro.	48.2	2.4	25.6	50.9	21.9	20.1	46.2	20.6	39.0	37.2	31.2	96.9	31.2
Yellow Mosby	......	......	......	......	......	......	......	......	40.6	34.2	37.4	88.2	28.4
Wood's Cockes Pro.	......	......	......	45.8	24.2	20.7	32.7	......	......	......	30.8	86.8	27.9
Wood's Gol. Pro.	......	......	......	......	23.7	20.2	35.0	20.0	40.5	31.9	28.5	83.6	26.9
Russell-Heckle G.D.	31.7	1.0	14.9	42.4	20.2	20.8	33.2	21.5	47.0	32.6	26.5	82.3	26.5
Wright's Pro.	......	......	......	......	......	......	......	16.0	38.5	34.9	29.8	80.5	25.9
Marchetti	......	......	......	......	......	21.7	29.1	21.1	38.8	31.4	28.4	80.0	25.8
Jarvis	......	......	16.7	39.4	17.7	18.8	31.7	22.9	40.5	29.0	27.1	78.6	25.3
Johnson's Pro.	......	......	......	......	......	......	......	17.7	31.1	32.6	27.1	73.2	23.6
Thompson's Pro.	......	......	......	......	......	......	......	......	33.6	28.0	30.8	72.6	23.4
Ferguson's Y. D.	26.8	1.8	14.9	29.8	14.6	15.1	34.8	17.5	40.1	25.6	22.1	68.6	22.1
Mosby Woodruff	......	......	......	......	19.1	12.4	33.6	15.0	......	......	20.0	66.7	21.5
Yellow Creole	......	......	......	......	......	......	31.4	13.1	......	......	22.2	64.0	20.6
Average of 8 check varieties	41.6	4.2	22.9	48.4	26.9	23.6	43.2	26.2	44.0	40.7	32.2	......	......

The check varieties are: Laguna, College Hybrid 47, Cockes Prolific, Neal's Paymaster, Mosby Station, Hastings Prolific, Ferguson's Yellow Dent, Russell-Heckle's Golden Dent.

*The percentage rating is arrived at by dividing the actual averages by the average for all checks during the years in which that variety was grown. This method is used in all yield tables.

variety is usually higher than any mentioned. Surcropper has the same weakness; it is a white variety.

Holly Springs

The Holly Springs Branch Station is located in north Mississippi in the brown loam area. The variety test was planted on the valley soils. The results are shown in table 2. The test was planted continuously except in 1930 when uncertainty of existing conditions made it necessary to dispense with test work during that year.

The average of all varieties on test each year is used as the basis for comparison. This average was 51.2 bushels per acre. The varieties rated as compared to this average range from 114% to 63% or a range in yield per acre from 58.4 bushels to 32.5 bushels. Paymaster and Jellicorse are the high ranking varieties, with Cockes Prolific, Mosby Station, and Hastings Prolific following closely behind. It is to be expected that Paymaster and Jellicorse would rank high at this Station since it is very near their origin in Tennessee. Those named are all white. The better yellow varieties are Golden Dent, Jarvis, and Wood's Golden Prolific. It is worth mentioning that no yellow variety ranked with the leading white varieties in yield in this test. It is felt, however, by some experienced agronomists that the earlier maturing varieties have considerable merit on thinner, less productive soils in this area.

Stoneville

The results of tests with corn varieties at the Delta Branch Station are given in table 3. The alluvial soils of the Mississippi Delta, probably the most consistently high producing cotton soils in the world, show very low yields of corn. This is, of course, due to the different growth habits of the two crops and to the fact that the environment favors cotton. Along with this, however, there is a marked difference in varietal response

TABLE 2—AVERAGE FOR THE TEST OF CORN VARIETIES AT HOLLY SPRINGS BRANCH STATION

	Yield in Bushels Per Acre												
	1928	1929	1931	1932	1933	1934	1935	1936	1937	1938	Av.	% Rating	Comp. Yield
Neal's Paymaster	65.6	71.7	62.1	41.7	32.1	65.2	48.5	60.5	66.3	70.0	58.4	114.1	58.4
Jellicorse	......	......	65.8	31.6	35.7	70.1	50.0	58.6	65.4	61.6	54.8	112.8	57.9
Cockes Pro. Sta.	70.6	70.0	67.5	39.0	29.9	59.1	39.7	48.2	65.1	62.2	55.1	107.6	55.1
Mosby, Station	68.3	60.8	62.9	34.8	32.1	47.4	40.9	48.2	75.8	65.5	53.7	104.9	53.7
College Hybrid 47	67.0	61.2	60.1	44.6	30.4	58.7	38.5	47.8	66.4	61.7	53.6	104.7	53.6
Hastings Prolific	60.3	82.4	84.2	30.9	29.9	45.4	30.3	43.4	60.5	54.4	52.2	102.0	52.2
Yellow Mosby	......	......	......	......	......	......	......	51.1	57.3	57.2	55.2	99.0	50.7
Mosby, Delta	64.9	63.4	63.7	36.9	30.6	53.6	37.2	44.8	56.5	47.0	49.9	97.5	49.9
Laguna	58.4	53.2	48.7	44.6	30.8	59.4	34.8	48.1	63.3	55.4	49.7	97.1	49.7
Thompson's Pro.	......	......	......	......	......	......	......	48.8	54.6	......	51.7	94.3	48.3
Wright's Pro.	......	......	......	......	......	......	32.8	50.0	56.3	53.6	48.2	93.6	47.9
Russell-Heckles GD	59.1	37.8	44.8	34.0	28.6	59.0	39.9	55.3	51.2	60.3	47.0	91.8	47.0
Jarvis	......	......	43.4	33.8	28.9	48.1	37.0	52.4	58.5	52.8	44.4	91.4	46.8
Wood's Gol. Pro.	......	......	......	34.3	25.1	50.6	37.0	47.3	55.6	43.5	41.9	88.8	45.5
Wood's Cockes Pro.	......	......	48.8	32.4	25.4	50.0	......	......	......	......	39.2	86.0	44.0
Marchetti	......	......	......	......	27.6	43.1	36.3	49.9	47.1	47.6	41.9	85.9	44.0
Whatley's Prolific	......	......	......	......	......	......	......	......	......	49.3	49.3	85.3	43.7
Surcropper	......	......	......	......	......	......	42.1	52.1	33.7	45.9	43.4	84.3	43.2
Ferguson's Y.D.	54.0	38.6	27.6	30.6	29.8	61.6	38.1	48.9	35.2	43.9	40.8	79.7	40.8
Mosby Woodruff	......	......	......	20.3	28.1	43.0	32.7	......	......	......	31.0	76.0	38.9
Pigott's Red Cob	......	......	......	......	......	......	......	......	42.6	......	42.6	71.0	36.4
Johnson's Prolific	......	......	......	......	......	......	25.9	33.5	51.0	......	36.8	74.5	38.1
Yellow Creole	....	.....	.....	.....	.....	40.4	23.9	......	......	......	32.1	67.4	34.5
Yellow Surcropper	......	......	......	......	......	......	......	......	......	36.7	36.7	63.4	32.5
Average of 9 check varieties	63.1	59.9	58.0	37.5	30.5	56.6	38.7	49.5	60.0	57.8	51.2	......	......

The check vaieties are: Neal's Paymaster, Cockes Prolific, Mosby Station, College Hybrid 47, Hastings Prolific, Mosby Delta, Laguna, Golden Dent, R. H., and Ferguson's Yellow Dent.

PAYMASTER—A HIGH PRODUCING SOFT CORN SUITABLE FOR NORTH THIRD OF STATE

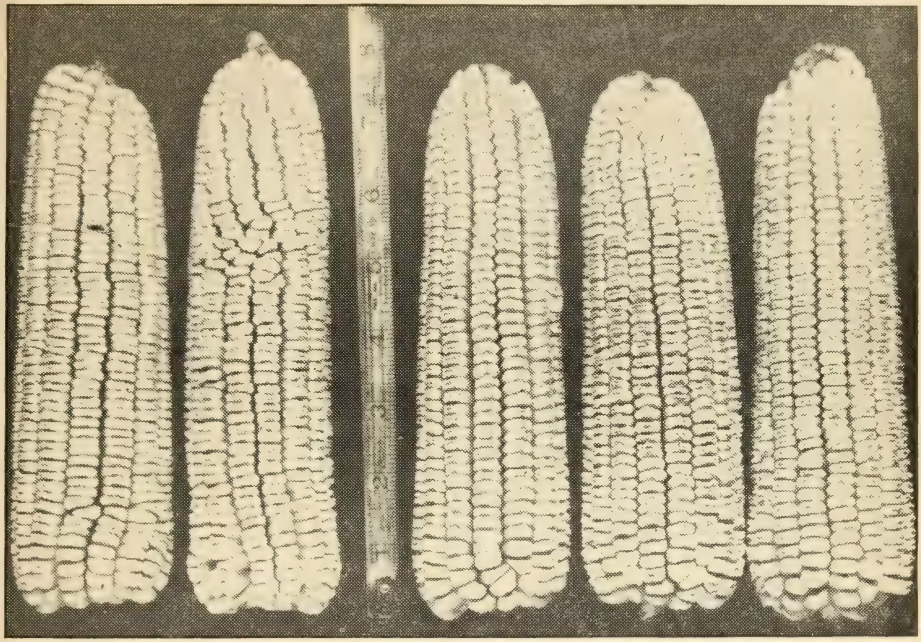


TABLE 3—THE AVERAGE FOR THE CORN VARIETY TEST AT STONEVILLE BRANCH STATION

	Yield in Bushels per Acre											%	Comp.
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Ave	Rating*	Yield
College Hybrid 47	49.9	20.9	58.1	24.5	20.0	31.4	30.5	42.2	14.7	31.1	32.3	110.6	32.3
Cockes Pro., Sta.	48.8	12.7	63.5	24.3	21.6	29.1	22.8	47.1	12.2	30.1	31.2	106.8	31.2
Laguna	48.2	19.8	58.4	26.1	22.2	22.1	23.2	49.0	14.7	26.8	31.1	106.5	31.1
Mosby, Delta	50.0	16.4	53.0	21.8	22.1	27.7	25.5	53.3	15.6	20.9	30.6	104.8	30.6
Jellicorse	...	16.0	58.3	27.6	24.4	23.7	24.0	40.7	15.4	26.3	28.5	104.4	30.5
Mosby, Station	43.4	13.5	53.4	25.1	23.2	24.9	22.6	53.2	16.0	20.4	29.6	101.4	29.6
Neal's Paymaster	46.0	22.2	54.6	20.0	20.8	29.4	22.4	41.4	12.7	24.4	29.4	100.7	29.4
Hastings Prolific	48.2	10.1	61.9	20.2	19.6	19.6	18.3	48.6	13.4	24.9	28.5	97.6	28.5
Yellow Mosby	......	......	......	......	......	......	......	36.6	16.4	24.5	25.8	94.5	27.6
Wood's Cockes Pro.	......	......	51.3	15.2	20.3	25.0	......	......	......	......	28.0	90.3	26.4
Woodruff's Mosby	......	......	......	21.4	19.6	25.4	15.4	......	......	......	20.5	89.1	26.0
Ferguson's Y.D.	39.0	19.4	41.5	19.5	21.3	26.5	22.7	33.3	13.6	17.6	25.4	87.0	25.4
Wright's Prolific	...	....	.....	.....	.....	......	18.8	34.0	12.4	25.5	22.7	87.0	25.4
Surcropper	......	......	......	......	......	......	21.5	35.1	16.8	17.6	22.7	87.0	25.4
Whatley's Prolific	......	......	......	.....	......	......	......	......	......	20.7	20.7	87.0	25.4
Russell-Heckle GD	40.5	18.5	47.1	14.7	16.6	29.3	16.6	31.9	10.7	17.6	24.3	83.2	24.3
Wood's Gol. Pro.	......	......	41.1	12.2	16.1	26.1	17.8	33.0	13.7	16.3	22.0	76.9	22.5
Jarvis	......	16.4	39.5	13.9	15.5	27.2	14.7	33.5	10.6	14.9	20.7	75.8	22.1
Marchetti	......	......	......	......	14.2	22.5	16.6	31.1	13.6	13.2	18.5	73.1	21.3
Thompson's Pro.	......	......	......	......	......	.. ....	......	32.3	10.1	......	21.2	72.1	21.3
Johnson's Prolific	......	......	......	......	......	......	10.8	31.9	10.2	......	17.6	65.4	19.1
Yellow Surcopper	......	......	......	......	......	......	......	19.1	13.5	20.6	17.7	64.8	18.9
Pigott's Red Cob	......	......	......	......	......	......	......	......	8.2	15.2	11.7	62.6	18.3
Yellow Creole	......	6.4	......	......	......	......	......	......	......	......	6.4	37.4	10.9
Average of 9 check varieties	46.0	17.1	54.6	21.8	20.8	26.7	22.7	44.4	13.7	23.8	29.2	......	......

The check varieties are: College Hybrid 47, Cockes Prolific, Laguna, Mosby Delta, Mosby Station, Neal's Paymaster, Hastings Prolific, Ferguson's Yellow Dent, and Russell-Heckle's Golden Dent.

*The percentage rating is arrived at by dividing the actual average by the average for all checks during the years in which that variety was grown. This method is used in all yield tables.

which is evidence of varying ability of varieties to make the most of the conditions. Here again there are several varieties from which to choose. Of the varieties, Station Cockes Prolific leads by a slight margin. College Hybrid 47 leads in production although it probably not significantly better than the next five or six down the list. It is considered well here to mention that College Hybrid 47 is the result of hybridizing Cockes Prolific and Laguna, the varieties ranking second and third in comparison with it.

Further study of the yield data of these three from year to year is interesting. It is during the adverse seasons when yields are exceptionally low that this cross builds its average above either of the parents.

Delta Mosby, Jelicorse, Mosby Station, and Paymaster are next, ranking in the order named. Yellow Mosby, a product of crossing Mosby and Yellow Creole is the outstanding yellow variety. It is in line also to mention that Yellow Mosby is a variety and is not to be confused as a cross, such as College Hybrid 47; the latter is a first generation cross between two varieties and seed should not be saved from it. Yellow Mosby originated from a similar cross, but was selected in for several generations for the Mosby type with yellow kernels and should be considered as a variety rather than a cross or hybrid. Seed may be saved from it as from any other variety.

Raymond

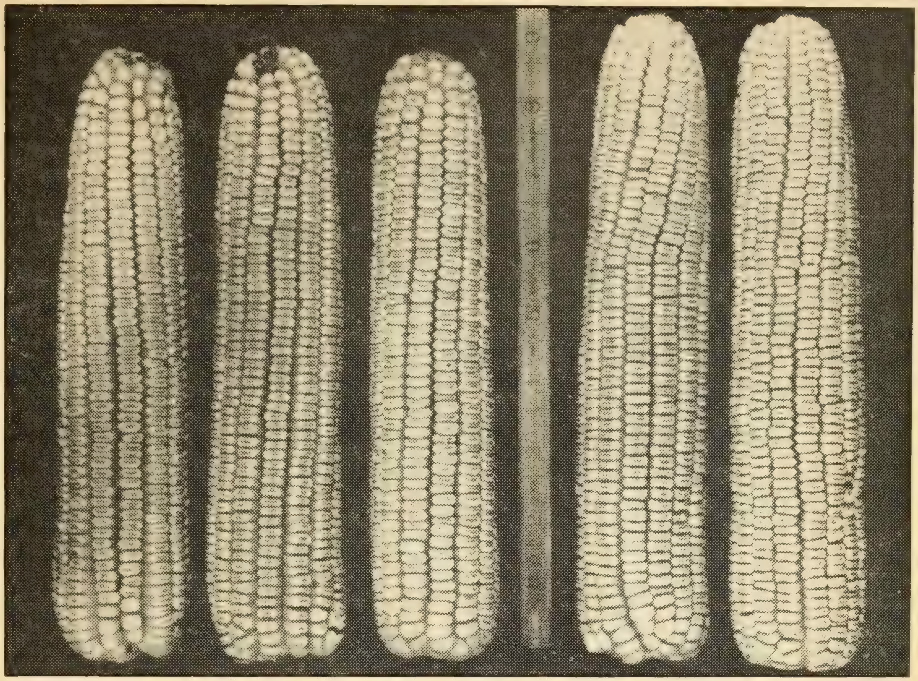
The Raymond Branch Station, located in Hinds County, is in the lighter phase of the brown loam soils. The corn variety test was conducted in the fertile valleys as was the case at Holly Springs.

The leading varieties for this area are very much the same as for other stations. Of the varieties, Laguna leads, with Neal's Paymaster, Jellicorse, Surcropper, Cockes Prolific, and Mosby Station following closely. The yield of Laguna is 50.4 and Mosby 46.7 bushels per acre. The difference between the highest and lowest yielding variety is 13.0 bushels or 27.2 percent. The better yellow varieties are Yellow Mosby, Golden Dent, and Golden Prolific.

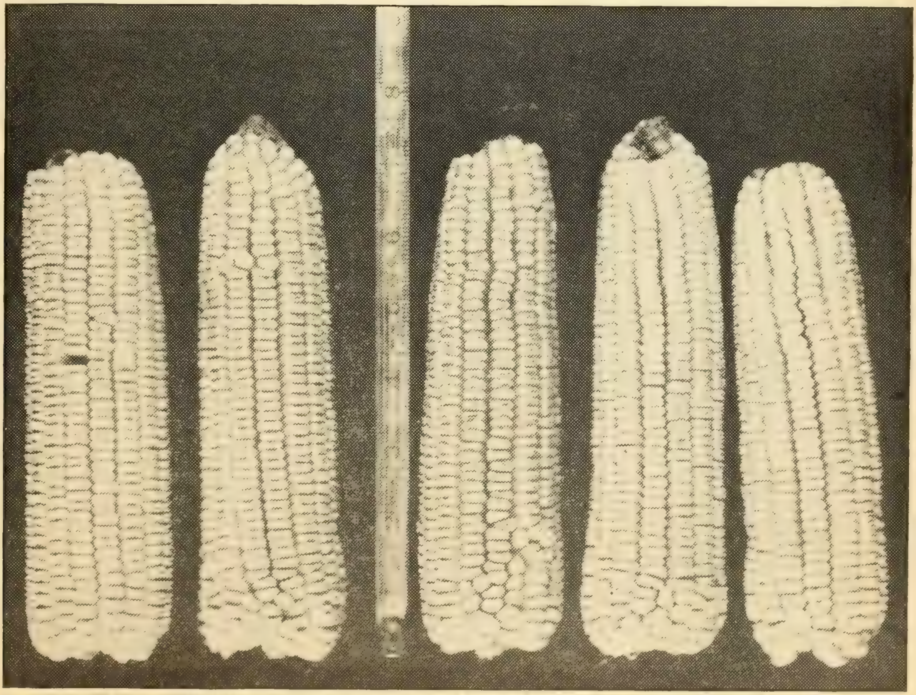
TABLE 4—THE AVERAGE FOR THE TEST OF CORN VARIETIES AT RAYMOND BRANCH STATION

	Yield in Bushels per Acre												
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Ave.	% Rating	Comp. Yield
College Hybrid 47	81.8	39.4	62.3	29.3	56.8	26.7	48.5	51.5	67.9	54.2	51.8	108.6	51.8
Laguna	78.9	32.1	57.7	30.8	57.8	24.2	49.9	56.4	65.6	50.3	50.4	105.7	50.4
Neal's Paymaster	72.2	37.0	60.7	19.4	59.1	28.5	48.6	57.6	63.8	51.5	49.8	104.4	49.8
Jellicorse	......	33.5	54.7	23.9	56.1	29.8	51.3	53.5	63.1	48.0	46.0	103.1	49.2
Surcropper	......	......	......	......	......	......	55.1	55.2	......	41.5	50.6	102.8	49.0
Cockes Pro. Sta.	75.4	31.6	61.5	18.4	56.4	25.9	44.7	52.3	66.1	51.7	48.4	101.5	48.4
Mosby, Station	71.5	25.7	53.6	23.5	54.9	23.0	39.0	55.9	68.3	51.5	46.7	97.9	46.7
Mosby, Delta	77.3	27.7	55.3	21.2	55.8	26.5	39.3	53.2	......	39.1	43.9	95.4	45.5
Hastings Prolific	76.5	31.1	53.5	21.0	51.2	20.8	38.8	54.0	53.8	40.1	44.1	92.4	44.1
Yellow Mosby	......	......	......	......	......	......	......	50.8	......	42.7	46.7	90.3	43.1
Russell-Heckle's Golden Dent	69.3	29.1	44.2	16.7	52.7	25.1	39.0	51.1	52.2	45.9	42.5	89.1	42.5
Ferguson's Y. D.	74.5	33.2	39.8	12.3	46.8	26.6	45.7	52.3	......	37.5	41.0	89.1	42.5
Wood's Gol. Pro.	......	......	......	......	49.5	20.8	38.7	52.5	......	41.5	40.6	89.0	42.5
Johnson's Pro	......	......	......	......	......	......	32.7	53.5	......	......	43.1	87.8	41.8
Wright's Pro	......	......	......	......	......	......	33.3	54.7	......	41.4	43.1	87.8	41.8
Jarvis	......	31.8	42.7	17.5	48.0	28.6	38.9	52.3	54.6	36.3	39.0	87.4	41.7
Marchetti	......	......	......	......	......	......	38.2	50.3	......	38.5	42.3	86.0	41.0
Whatley's Prolific	......	......	......	......	......	......	......	......	......	40.3	40.3	81.7	39.0
Yellow Surcropper	......	......	......	......	......	......	......	......	......	38.7	38.7	78.5	37.4
Average for 7 check varieties	75.1	32.3	56.2	22.7	55.6	24.9	44.1	54.1	62.5	49.3	47.7	......	......

Check varieties are: College Hybrid 47, Laguna, Neal's Paymaster, Cockes Prolific, Mosby Station, Mosby Delta, and Hastings Prolific.



MOSBY—A VERY POPULAR GENERAL PURPOSE CORN



WHATLEY—PROLIFIC, HIGH PRODUCER, SMALL EARED; NOT WIDELY DISTRIBUTED

Natchez

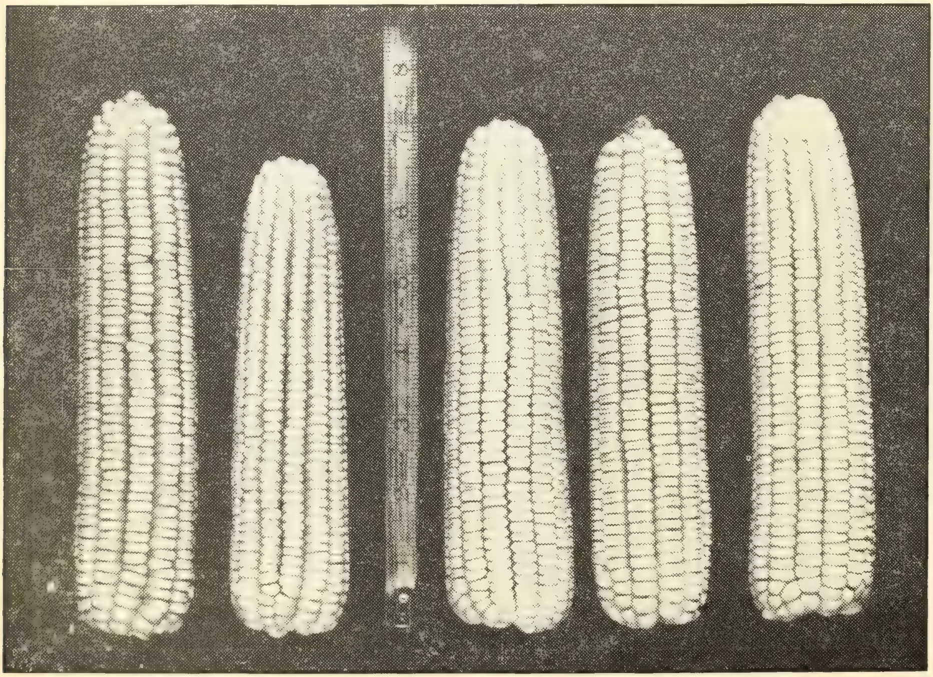
The Branch Station at Natchez is located on the deep phase of the Brown loam area, a soil type known as Memphis Silt Loam. Only seven years data are available for this Station because it was established just prior to 1930 and consequently that was the first year a test was conducted. There was no test during the year of 1932, and the very poor stand made the test of no value in 1938.

The varieties outstanding in this area are Delta Mosby, Hastings Prolific, Mosby Station, Jellicorse, Laguna, and Cockes Prolific. College Hybrid 47 ranks well among these. Yellow Mosby is the outstanding yellow variety. It is, however, 5.5 bushels lower than the best white variety.

Poplarville

This Branch Station is located in Pearl River County in south Mississippi. The soil is of the coastal plain type and not very fertile. The variety test has usually been fertilized before planting with 400 to 600 pounds of a complete fertilizer and side-dressed with nitrate of soda later in the growth period.

Despite the low yield, which was 26.1 bushels per acre for the average of the check varieties, there is a difference of 10.8 bushels between the high and low yielding variety or a difference of more than 30 percent. The leading varieties are: Jellicorse, Hastings Prolific, Neal's Paymaster, and Laguna for white varieties, and Russell-Heckle's Golden Dent for yellow. College Hybrid 47 leads in production. It is not included in the discussion of varieties because it is a cross between two varieties and should not be designated as a variety.



HASTINGS—PROLIFIC, HIGH PRODUCER, SMALL EARED, WIDELY GROWN

TABLE 5—THE AVERAGE FOR THE TEST OF CORN VARIETIES AT NATCHEZ BRANCH STATION

	Yield in Bushels per Acre									
	1930	1931	1933	1934	1935	1936	1937	Av.	% Rating	Comp. Yield
Mosby, Delta	34.2	46.1	51.6	14.7	38.3	51.1	42.0	39.7	114.1	39.7
Hastings Prolific	27.3	52.8	47.8	17.0	41.1	56.1	32.1	39.2	112.6	39.2
College Hybrid 47	31.0	43.5	38.0	13.9	41.2	50.9	49.9	38.3	110.1	38.3
Mosby, Station	30.1	36.8	40.8	12.7	37.2	50.2	45.6	36.2	104.0	36.2
Jellicorse	28.0	47.4	34.3	13.5	38.4	50.9	40.5	36.1	103 7	36.1
Laguna	29.5	45.8	40.9	14.4	32.9	49.5	37.3	35.8	102.9	35.8
Cockes Prolific, Station	28.7	46.0	45.1	14.6	37.2	50.2	22.9	35.0	100.6	35.0
Yellow Mosby	......	......	......	......	......	40.9	40.6	40.7	98.3	34.2
Johnson's Prolific	......	......	......	......	34.8	45.1	34.4	38.1	96.0	33.4
Neal's Paymaster	28.9	42.2	40.4	11.8	36.9	38.7	25.7	32.1	92.2	32.1
Wright's Prolific	......	......	......	......	31.5	38.8	34.2	34.8	87.7	30.5
Surcropper	......	......	......	......	28.2	42.1	33.8	34.7	87.4	30.4
Ferguson's Yellow Dent	28.3	30.6	36.4	10.1	31.0	29.5	38.8	29.2	83.9	29.2
Wood's Cockes Prolific	.....	33.1	34.0	9.4	......	......	......	25.5	80.2	27.9
Wood's Golden Prolfic	......	......	34.9	12.7	27.7	32.4	30.7	27.7	80.3	27.9
Jarvis Golden Prolific	27.8	35.9	32.6	11.4	25.4	31.4	28.5	27.6	79.3	27.6
Russell-Heckle's Golden Dent	24.8	29.4	29.7	6.4	29.5	30.1	36.3	26.6	76 4	26.6
Marchetti	......	......	28.8	12.0	27.0	33.7	29.9	26.3	76.2	26.5
Thompson's Prolific	......	......	......	......	......	15.4	26.8	21.1	51.0	17.7
Average of 10 check varieties	29.1	42.1	40.5	12.9	36.4	45.7	37.1	34.8	......	......

Check varieties are: Mosby Delta, Hastings Prolific, College Hybrid 47, Mosby Station, Laguna, Cockes Prolific, Neal's Paymaster, Ferguson's Yellow Dent, Jarvis, and Russell-Heckle's Golden Dent.

TABLE 6—THE AVERAGE FOR THE TEST OF CORN VARIETIES AT POPLARVILLE BRANCH STATION

	Yield in Bushels per Acre											
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Ave	% Rating	Comp. Yield
College Hybrid 47	37.0	11.2	32.5	23.8	35.2	27.6	43.6	13.5	31.2	28.5	28.4	108.8	28.4
Jellicorse	......	......	32.5	23.1	37.0	29.8	39.5	17.4	25.0	19.6	28.0	104.5	28.0
Hastings Pro	35.5	10.0	31.9	23.0	36.4	34.4	42.3	16.5	26.8	22.3	27.9	106.9	27.9
Neal's Paymaster	35.5	14.3	28.9	17.5	32.5	26.3	44.5	14.7	27.6	25.0	26.7	102.3	26.7
Laguna	37.0	11.9	30.2	26.6	29.0	28.0	37.8	16.9	24.2	25.9	26.7	102.3	26.7
Russell-Heckle's Golden Dent	32.0	16.6	27.4	......	40.2	26.4	40.2	15.1	20.5	22.3	26.7	100.8	26.3
Mosby Delta	36.5	8.8	32.2	28.6	28.3	31.2	35.7	10.2	25.0	21.4	25.8	98.9	25.8
Cockes Pro. Sta.	34.5	10.0	32.1	19.6	23.5	32.5	40.6	12.5	27.6	23.2	25.6	98.1	25.6
Wood's Gol. Pro.	......	......	......	......	33.0	25.4	37.1	15.6	24.2	22.3	26.3	97.8	25.5
Yellow Mosby	......	......	......	......	......	......	......	17.4	19.4	25.0	20.6	96.7	25.7
Jarvis Gol. Pro.	......	......	29.3	22.7	34.3	25.9	34.5	17.8	23.2	19.6	25.9	96.6	25.2
Marchetti	......	......	......	......	32.1	29.8	31.9	15.1	24.2	23.2	26.0	96.7	25.2
Wright's Prolific	......	......	......	......	......	......	34.4	15.6	22.0	25.0	24.2	94.9	24.8
Whatley's Prolific	......	......	......	......	......	......	......	......	......	21.4	21.4	93.0	24.3
Yellow Surcropper	......	......	......	......	......	......	......	......	......	21.4	21.4	93.0	24.3
Mosby Station	41.0	9.0	31.6	16.6	21.7	27.2	35.7	13.5	28.5	18.7	24.3	93.1	24.3
Fergerson's Y. D.	27.5	13.3	30.0	19.2	28.1	24.5	23.6	17.8	25.0	19.6	22.9	87.7	22.9
Johnson's Pro.	......	......	......	......	......	......	36.7	12.0	15.1	......	21.3	81.0	21.1
Thompson's Pro.	......	......	......	......	......	......	......	15.5	16.0	......	15.7	77.0	20.1
Surcropper	......	......	......	......	......	......	24.7	16.5	16.0	19.6	19.2	75.3	19.6
Average for 8 check varieties	35.2	11.7	30.8	22.4	30.5	28.7	38.2	14.5	26.3	23.0	26.1	......	......

Checks were: College Hybrid 47, Hastings Prolific, Neal's Paymaster, Russell-Heckle's Golden Dent, Laguna, Cockes Prolific, Mosby Delta, Mosby Station, and Ferguson's Yellow Dent.

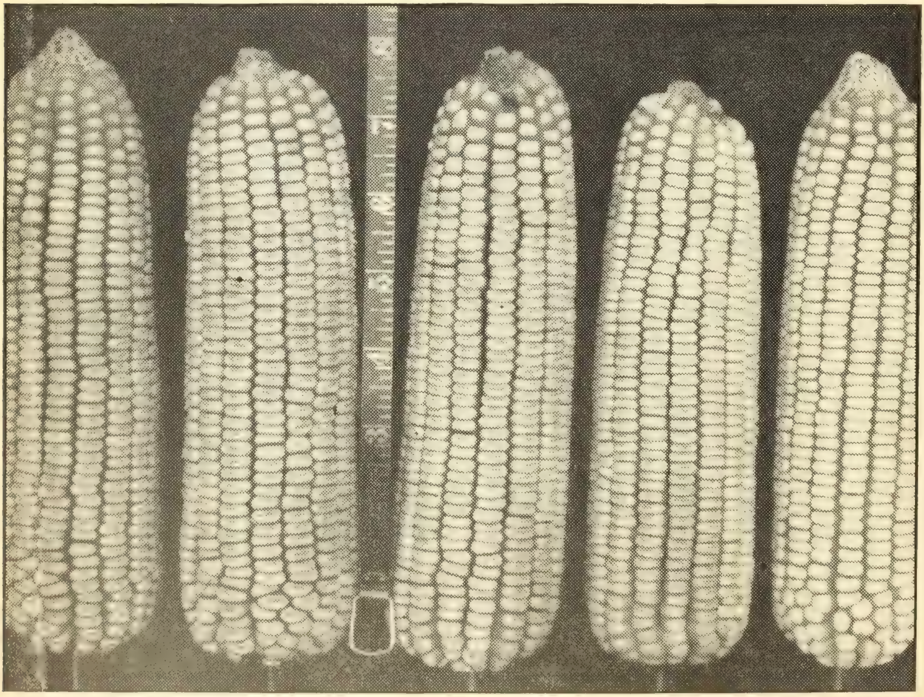
Effect of Early and Late Planting Upon the Yield of Corn Varieties at State College

Tables 1-a and 1-b show the yields of varieties planted early, about April 1, and late, June 1. The results show plainly enough that early planting is better than that as late as June 1. It often happens that varieties planted at the early date are able to mature the crop before the usual very hot dry weather begins. Since it is not always possible to plant at the optimum date, it is helpful to know which variety or varieties do best when planted later than April or May.

The results of the two plantings over a ten-year period are shown in figure 1. It will be noted that Laguna, while not a top producer in the early planting, is far in the lead for the June planting. Laguna is of the Mexican June type and doubtless has the ability of this related variety to stand up under the excessive heat and drought to which corn is usually subjected when planted as late as June.

Further tests were conducted in order to determine the relative performance of a variety doing best in the early test with the performance of Laguna. The figure shows the comparative yields of Mosby and Laguna, when planted each month from March to July. Both corn varieties do better when planted in April than in March. Laguna is distinctly superior when planted later than May. However, neither of the corn varieties yield as well when planted late as when planted in time for the normal growing season.

The value of a corn variety is manifested in the yield of sound grain it produces. Yield depends upon the ability of the corn plant to make the best use of the favorable growing season. The favorable



LAGUNA—AN EXCELLENT CORN FOR PLANTING AFTER THE MIDDLE OF MAY

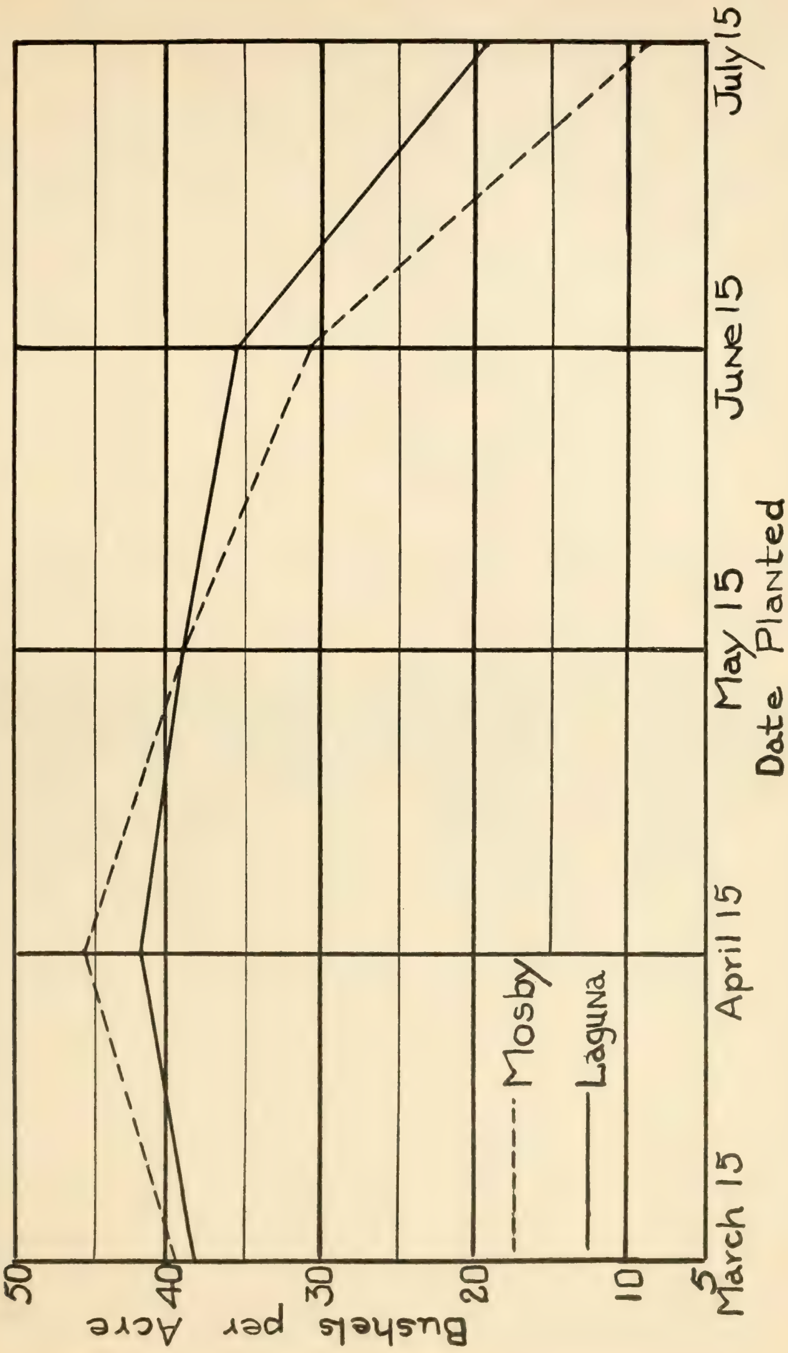


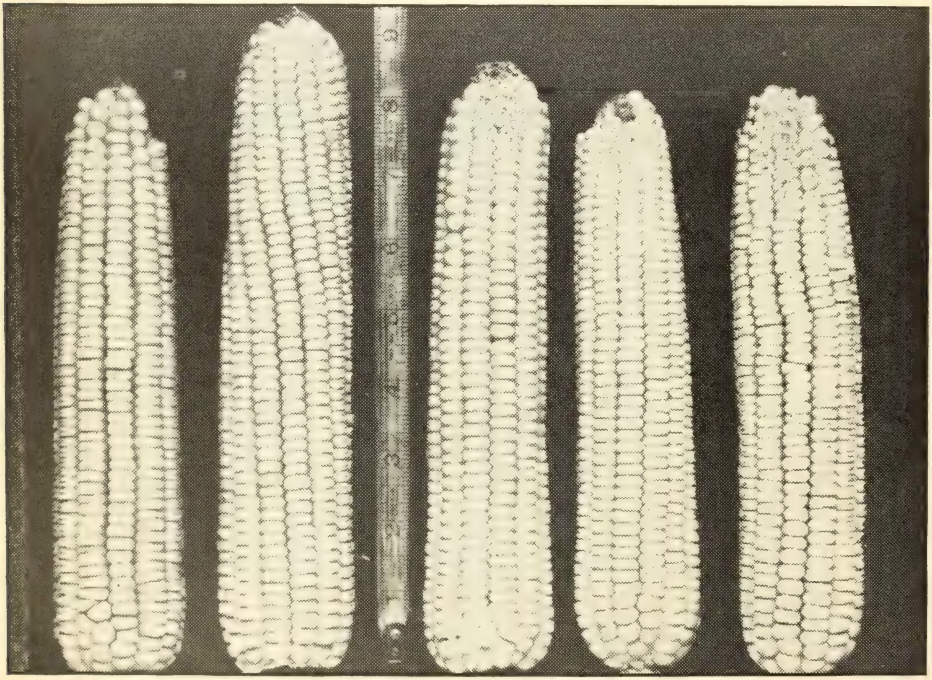
FIGURE 2. EARLY PLANTING VS. LATE PLANTING OF TWO CORN VARIETIES AT STATE COLLEGE

growing season is cut short in Mississippi by the droughts occurring in late summer. It must be borne in mind that the yield of corn in Mississippi is largely dependent upon the weather conditions during the last 30 or 35 days of its growth, or from about the time it begins to prepare to tassel and silk until well past roasting ear stage.

The ranking of varieties in the early tests is given in the discussion of varieties at State College. Laguna is outstanding in the late test with a yield of 40.4 bushels per acre. The lowest yielding variety produces only 22.1 bushels. The variety ranking second to Laguna yields 33.9 bushels or a difference of 9.3 bushels per acre. This is illustrative of varietal difference in ability to withstand hot dry weather. The season during the critical stage of growth of corn planted as late as June is frequently very hot and dry. Laguna has the ability to stand up better under these circumstances than any variety on test. If more favorable weather prevailed, the yields of other varieties would more closely approach that of Laguna. This characteristic makes Laguna a valuable variety for Mississippi farmers.

Regional Adaptation Characteristics Of Certain Varieties; Hybrid Corn

It is not expected that all corn varieties will prove to be equally adapted to all regions in the state. For this reason an effort is made to present all standard varieties in such manner that an intersectional comparison may be made. Table 7 gives the yield for 19 varieties and College Hybrid 47 at each station and the state-wide average for each variety at all locations.



COCKES—A BIT IRREGULAR IN TYPE, BUT A HIGH PRODUCER

TABLE 7—REGIONAL ADAPTATION OF CORN VARIETIES

	State College		Holly Springs		Stoneville		Raymond		Natchez		Poplarville		
	Yield	Rank	Yield	Rank	Yield	Rank	Yield	Rank	Yield	Rank	Yield	Rank	Ave.
College Hybrid 47	53.0	....	53.6	....	32.3	....	51.8	....	38.3	....	28.4	....	42.9
Jellicorse	52.1	2	57.9	2	30.5	4	49.2	4	36.1	3	28.0	1	42.3
Neal's Paymaster	54.0	1	58.4	1	29.4	6	49.8	2	32.1	9	26.7	3	41.7
Cockes Pro. Sta.	51.8	3	55.1	3	31.2	1	48.4	6	35.0	6	25.6	6	41.2
Laguna	48.7	6	49.7	8	31.1	2	50.4	1	35.8	5	26.7	4	40.4
Mosby, Station	50.8	4	53.7	4	29.6	5	46.7	7	36.2	4	24.3	13	40.2
Hastings Prolific	49.3	....	52.2	5	28.5	7	44.1	9	39.2	2	27.9	2	40.2
Mosby, Delta	47.2	8	49.9	7	30.6	3	45.5	8	39.7	1	25.8	7	39.8
Yellow Mosby	45.8	9	50.7	6	27.6	8	43.1	10	34.2	7	25.7	8	37.9
Surcropper	48.5	7	43.2	16	25.4	9	49.0	5	30.4	11	19.6	19	36.0
Wright's Prolific	44.0	10	47.9	10	25.4	10	41.9	14	30.5	10	24.8	12	35.8
Russell-Heckle GD	43.7	12	47.0	11	24.3	13	42.5	11	26.6	15	26.3	5	35.1
Whatley's Prolific	43.3	13	43.7	15	25.4	11	39.0	18	......	....	24.3	14	35.1
Ferguson's Y. D.	44.0	11	40.8	17	25.4	12	42.5	12	29.2	12	22.9	15	34.1
Wood's Gol. Pro.	40.3	16	25.5	13	22.5	14	42.5	13	27.9	13	25.5	9	34.0
Jarvis	40.7	15	46.8	12	22.1	15	41.7	17	27.6	14	25.2	10	24.0
Thompson's Pro.	41.8	14	48.3	9	21.3	16	49.5	3	17.7	17	20.1	18	33.1
Marchetti	37.7	18	44.0	14	21.3	17	41.0	16	26.5	16	25.2	11	32.6
Johnson's Prolific	40.1	17	38.1	18	19.1	18	41.8	15	33.4	8	21.1	16	32.3
Pigott's Red Cob	34.7	19	36.4	19	18.3	19	......	....	......	....	20.3	17	27.4

In order to obtain full benefit from such study, it is best to look further into the table than merely observe the average for the entire group. College Hybrid 47 would be considered as widely adapted over the state because of its rating near the top at all stations. Of the varieties, Jellicorse, Neal's Paymaster, and Cockes Prolific are the three highest in average for each station. Paymaster ranks in the upper three in four locations, or at all stations except Stoneville and Natchez; Jellicorse places similarly at all stations except Stoneville and Raymond; Cockes Prolific is slightly better in north Mississippi than in the south. Hastings ranks higher at the stations in the southern part of the state. Golden Dent also does best comparatively in the southern part of the state.

Figure 3 shows the six high yielding varieties at each station. (This number is arbitrarily selected and does not mean the third to ninth could not just as well be considered.) These varieties are listed numerically as to yield at each station. The list is exclusive of College Hybrid 47. Jellicorse and Cockes Prolific are listed in each section, but their rating varies at the different points. Paymaster is listed in all except Natchez, Laguna in all except Holly Springs, and Mosby and Hastings Prolific are present four out of the six locations.

From the foregoing study it may be concluded that a number of the better varieties have a wide range of adaptation over the state. None of the very inferior ones are outstanding at any point.

Characteristics of Varieties

Each corn variety is identified by certain definite characteristics or combination of characteristics not common to others. In many cases differences are not well defined and it is only by thorough knowledge of such examples that their identity may be determined. Not nearly all the numerous varieties grown in Mississippi could be included in the study. Twenty varieties, the majority of which are well known over the state, have been grown at State College and studied for a number of ear characteristics. The results are tabulated in table 8. They include a number of characteristics and kernels, and the relative length of the growing season. The ear samples were taken from the early variety test.

Kernel color. This merely shows in a general way whether a variety may be classed as white or yellow. It is well known that considerable variation is present in shades of color in each class.

Volume weight. Volume weight as used in this case refers to the relative weights per volume of a sample of kernels as compared to an equal volume of water. This is an effort to measure the density or relative hardness of kernels. A 100 gram sample of shelled corn of each variety was separately immersed in a vessel filled with water and the water displaced measured. A cubic centimeter of water is taken to weigh 1 gram. Then the weight of the sample of corn divided by the number of cubic centimeters of water displaced gives the term listed under volume weight.

Percent weevil damage. A weighed sample of grain from each variety was poured into containers made of one-fourth inch mesh hardware cloth. These were put in a screened compartment with a large number of insects known to damage corn in the crib. After 4 to 6 months the corn was reweighed and cleaned with a small commercial type grain cleaner. It was then weighed again and the loss taken as due to weevil and moth damage. The difference in weevil damage is not great enough to be considered as real. The data in this and the preceding column should not be taken as final. They are presented as preliminary and only for the consideration of the reader.

Since the denser kernels appear to be attacked no less than the softer ones, it would indicate that hardness of kernels may not be so important a factor in resisting insect damage. The insects have had free access to all varieties in this case.

The length and diameter of ear, number of rows of kernels are self-explanatory. There is no great difference between any varieties measured.

Number of days from planting to silking. This is the accepted method of measuring the relative earliness or lateness of a variety. There is a difference of 9 days between the earliest—Jarvis, Ferguson's Yellow Dent, and other yellow varieties—and Hastings Prolific. This is sufficient difference to permit success or failure of a corn crop where rainfall is the limiting factor, and is important to the extent that moisture deficiency occurs during the crucial fruiting season. The length of growing season taken at State College with the planting date around the

TABLE 8—MEASUREMENTS OF SOME CHARACTERISTICS OF WELL-KNOWN CORN VARIETIES

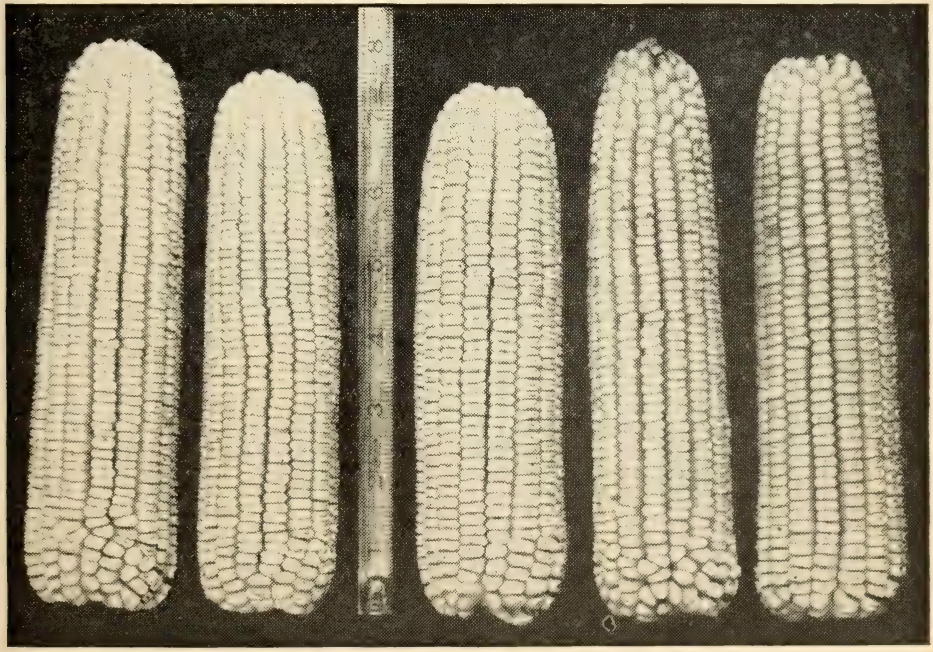
	Kernel Color	Volume Weight	% Weevil Damage	Length Ear— inches	Dia. of Ear— inches	No. Rows of Kernels	No. Days From Planting to Silking
Mosby Station	White	1.20	15.9	8.0	1.9	14	88
Mosby Delta	White	1.27	15.2	7.3	1.9	16	89
Cockes Prolific	White	1.24	16.5	7.8	1.9	14	89
Hastings Prolific	White	1.22	16.8	6.7	1.7	14	92
Jellicorse	White	1.21	16.2	7.2	2.0	14	86
College Hybrid 47	White	1.21	16.3	8.0	2.0	14	89
Laguna	White	1.27	14.5	7.9	2.0	14	89
Johnson's Prolific	White	1.23	14.6	7.0	1.9	14	....
Wright's Prolific	White	1.22	16.2	7.0	2.0	14	86
Surcropper	D. White	1.16	15.2	7.4	2.2	14	84
Paymaster	White	1.17	16.9	6.8	2.1	14	84
Thompson's Prolific	White	1.20	15.6	6.7	1.9	....	....
Ferguson's Yellow Dent	Yellow	1.18	16.3	7.6	2.1	14	83
Jarvis	Yellow	1.28	15.6	7.0	1.7	12	83
Wood's Golden Prolific	Yellow	1.25	14.1	7.4	2.0	14	83
Russell-Heckle Golden Dent	Yellow	1.20	15.7	7.9	2.1	16	86
Marchetti	Yellow	1.24	14.7	6.9	1.9	14	84
Yellow Mosby	Yellow	1.23	15.3	8.0	1.9	14	86
Pigott's Red Cob	White	1.26	5.7	5.3	2.0	18	85
Whatley's Prolific	White	......	......	.....	1.9	14	90

first of April must not be too broadly accepted since the actual season would vary as to date of planting and location. Later planted corn would give a shorter growing season. The author of Texas Bulletin No. 397 shows that, on the average, 10 days delay in planting shortens the time between planting and silking 5 days. For example, if a variety planted April 1 silked in 90 days, the same variety planted June 1 would silk in approximately 60 days. There would be a difference of one month in the length of growing season of that variety, due to the difference in planting dates. The April planting would silk about July 1 and the June planting August 1. This is entirely in line with observations made at this Station.

Hybrid Corn

With the widespread planting of hybrid corn in the Corn Belt, it is only natural to expect considerable interest to be developed in the South. As breeding methods develop, and when further accomplishments are made toward developing material suitable for southern conditions, it is not unlikely that profitable yields may be made from hybrids on the better corn land in Mississippi. One must not, however, expect miracles from such. Hybrids are as dependent upon favorable growing conditions as are our ordinary varieties. It is their ability to perform more efficiently under favorable conditions that gives them the edge over common varieties.

To farmers anticipating planting seed of hybrids, a word of caution is offered. This Experiment Station system is putting forth an effort to determine the value of some of the numerous hybrids offered for sale by conducting yield tests over the state. The results will be available to anyone interested. It would be somewhat risky to plant any hybrid that has not been tried out under southern conditions. If a hybrid is not considerably better than the better varieties, it would not be worth-



JOHNSON'S PROLIFIC—UNIFORM IN TYPE: A MEDIUM PRODUCER while to pay the increased price asked for the seed. No northern hybrids tried have shown to be superior to varieties commonly recommended.

Description and Origin of Some Well Known Corn Varieties in Mississippi

Cockes Prolific:—Named for General Cocke of Bremo Farm in the James River Valley of Virginia and recognized before the Civil War. J. B. Allen of Port Gibson, Mississippi, made selections from it. Dr. H. B. Brown obtained seed from Mr. Allen in 1915 and did further work with it at the Mississippi Experiment Stations.

Cockes Prolific is a white variety usually producing two or more ears per stalk. Ears are a little larger than Hastings, but considerably smaller than Mosby. Ears slightly tapering, 7½ to 8½ inches in length, 1½ to 2 inches in diameter, and bear 12 to 14 rows of kernels. Kernels of medium length, broad, plump, and grayish white in color with very slight indentations. Cob small and white. Matures in 120 to 125 days.

College 47:—First produced at the Mississippi Experiment Station by the hybridization of two well known varieties, Cockes Prolific and Laguna. Like Laguna it has considerable ability to withstand adverse weather conditions. Ears medium to large and tapering, 8 to 9 inches in length and 2 to 2½ inches in diameter. Cob white, medium large, and bears 14 to 16 rows of kernels. Kernels are pearly white, medium length, wide, and plump with smooth creased indentation. Ear tips seldom filled well, butts flat. Matures in 120 to 125 days.

Since this is a cross between two varieties, it must be treated as a hybrid and new seed obtained each year for planting. It is a varietal cross; and therefore not a hybrid between inbred lines.

Golden Dent:—A good yielding yellow variety, ears large and slightly tapering 8 to 9 inches long and 2 to 2½ inches in diameter, bears 16 rows of kernels. Kernels medium length, wide, plump, and golden yellow in color; smooth dimpled to rough creased indentation. Matures in 115 to 120 days.

Hastings:—The exact origin of this corn is not known. H. G. Hastings and Company, Atlanta, Georgia, obtained seed first from a Georgian whose father had grown the corn before the Civil War. The seed having first been obtained from a covered wagon transit passing through Georgia from the Carolinas. The Hastings firm has selected, developed and grown this corn since before 1900.

Hastings is a true prolific characterized by small ears 6½ to 7½ inches in length and 1½ inches in diameter. Cob is small and white bearing 12 to 16 rows of kernels, usually two to four ears per stalk. Kernels of medium length, hard, slightly indented, and grayish white in color. Matures in 125 to 130 days.

Jarvis:—Developed by J. M. Jarvis, Winston-Salem, North Carolina. Mr. Jarvis followed the system of field selection from stalks which produced two good ears. Other points were probably kept in mind, but the chief consideration was given to yield. Jarvis also seems to have an advantage in soil adaptability.

It is a true prolific yellow variety easily distinguished by its white cob and other ear and plant characters. It has a medium low stalk, with low set ears 7 to 8 inches in length and 1½ to 2 inches in diameter. Twelve to 14 rows of kernels, slightly tapering, and golden yellow in color. Kernel of medium length, broad, full, hard, and very slightly indented. Butts flat, tips fair. Matures in 115 to 120 days.

Jellicorse:—A white variety of corn developed by Reggie Jellicorse, Elmwood, Tennessee. Selections were made by Mr. Jellicorse for yield and quality of grain. The grain is of excellent quality. Ears are 6½ to 7½ inches in length and approximately 2 inches in diameter. Cob white and bears 12 to 16 rows of kernels. Matures in 120 to 125 days.

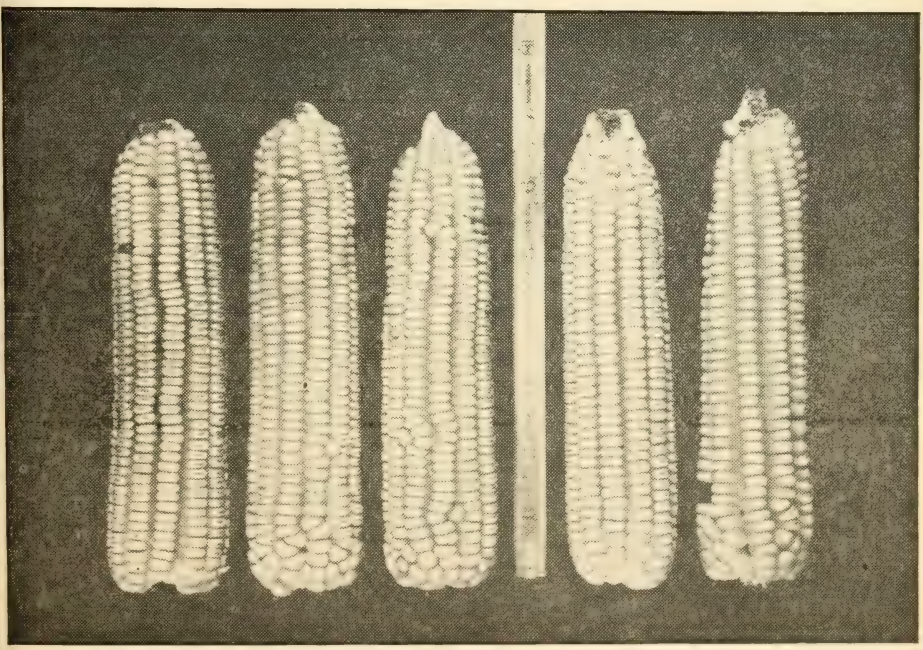
Jellicorse has proven to be a high yielding variety in the northern one-third of the state, but may be questionable in the central and southern portions.

Johnson's Prolific:—A white variety resembling Mosby except the ears are a little shorter. Ears 6½ to 7½ inches in length, 1½ to 2 inches in diameter. Cob white and bears 14 rows of kernels. Developed by J. W. Johnson, Quitman, Miss.

Laguna:—for a number of years Laguna has been kept in a high state of production by the Mississippi Experiment Station. Apparently this is one of the best varieties known for late planting in this state. Although the time required for the maturing of Laguna is approximately the same as for Mosby and other varieties, it seems to stand the adverse weather conditions that usually occur during the latter part of the growing season, and like Mexican June will build its yield above other varieties planted under these conditions.

Laguna is a white variety with medium size stalks and medium ear height. Ears 7½ to 8½ inches in length and 2 inches in diameter. Kernels broad, medium length, and plump with a characteristic white cap. Indentation smooth creased to dimpled. Cob white, medium size, and bears 14 rows of kernels. Tips of ear seldom well filled, butts flat. Matures in 120 to 125 days.

Marchetti:—A yellow dent variety developed by J. W. Marchetti, Hazelhurst, Mississippi. Relatively small ears 6½ to 7 inches long and 1½ to 2 inches in diameter, usually very irregular in length. Cob dull red and bears 14 rows of kernels. Kernels of medium length and plump with smooth to rough indentations. Matures in 115 to 120 days.



JARVIS—A VERY POPULAR YELLOW CORN

Mosby:—Developed by J. K. Mosby, Lockhart, Mississippi, in the late 90's. Later strains including Delta Mosby, Woodruff's Mosby, Suttle Mosby, and others have been developed by the experiment stations and individual breeders.

Mosby is a white semi-prolific variety, normally producing one large ear and a nubbin to two medium sized ears per stalk. Ears 8 to 9 inches long, slightly tapering and approximately 2 inches in diameter. Cob is white and bears 14 rows of kernels. Kernels are of medium length, wide, wedge shape, and roughly indented. Tip of ear usually not so well filled. Matures in 120 to 125 days.

Neals Paymaster:—Developed by W. H. Neal of Lebanon, Tennessee. Mr. Neal began some 25 years ago with a mixed variety and has persistently selected for yield and a red cob. He made his selections in the field from plants that produced two good-sized ears to the stalk.

Paymaster is a white variety with a medium sized stalk and medium ear height. Ears are 7 to 8 inches in length and 2 to 2½ inches in diameter, slightly tapering, and bear 14 to 16 rows of kernels. Grain is long, wide, flat, and ivory or straw white in color. Cob is small and light red. Matures in 115 to 120 days.

This variety is probably one of the best that can be grown in the northern one-third of the state, but like Jellicorse may be questionable in the central and southern portions.

Pigotts Red Cob:—Originated and developed by B. W. Pigott & Son, Tylertown, Mississippi.

This variety is sometimes called shoe peg corn. It has long pointed kernels and a very small cob. Ears 5 to 6 inches long, 1½ to 2 inches in diameter. Cob very small, deep red, and bears 16 to 20 rows of kernels. Kernels are ivory or straw white in color, extremely long, narrow, and almost round with very rough or beaked indentation. Matures in 120 to 130 days.

Surcropper:—This variety was originated and developed in Texas. The grain is creamy white and very susceptible to ear rot. Ears 7 to 8 inches in length and approximately 2 inches in diameter. Cob white and bears 14 rows of kernels. Indentation smooth to rough creased Matures in 115 to 120 days.

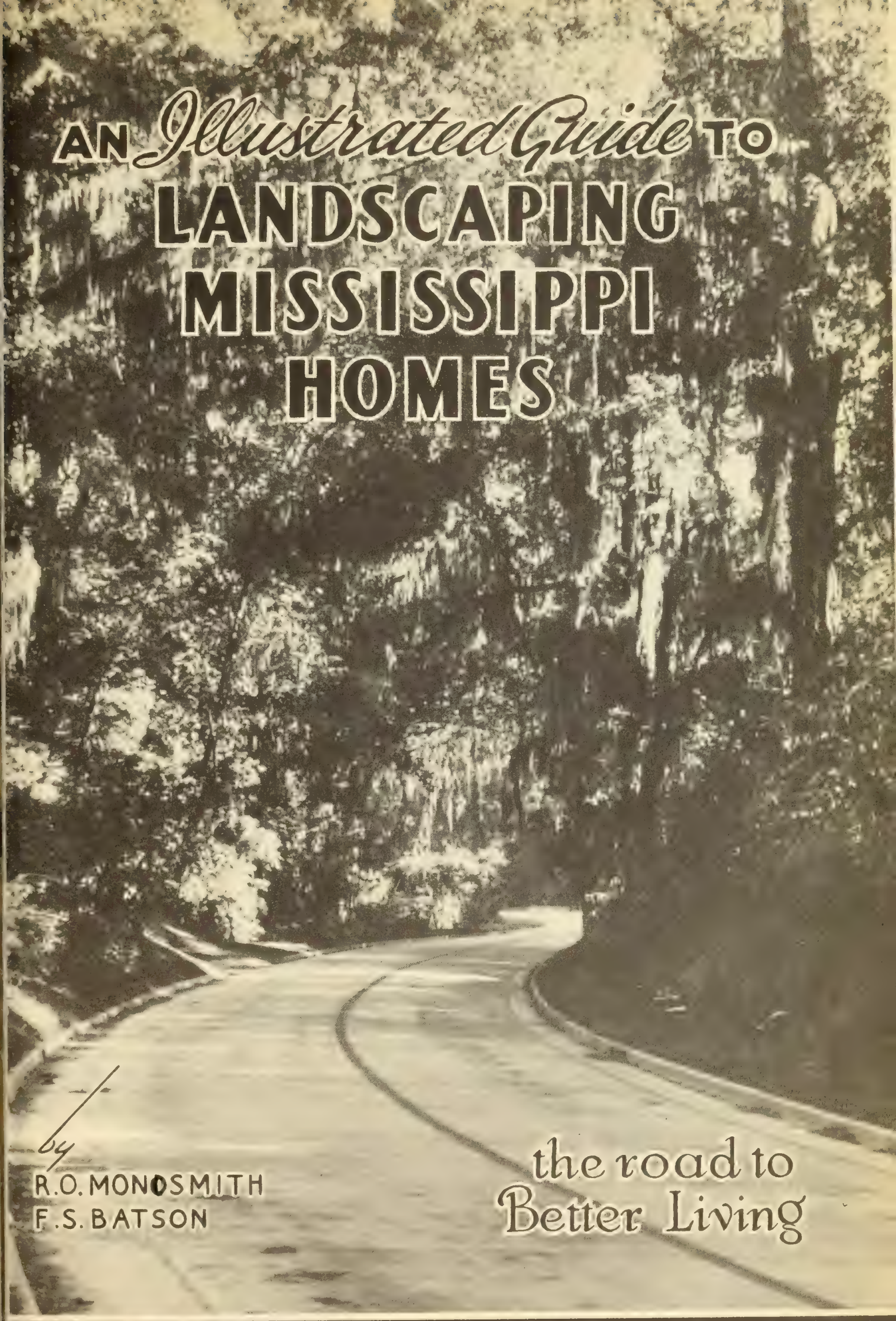
Whatley Prolific:—Originated and developed by Whatley Brothers, Helena Georgia. It is a white variety with a red cob, resembling Paymaster to some degree but can be identified quite well from it. Ears 6½ to 7 inches in length and 1½ to 2 inches in diameter. Cob dull red and bears 12 to 14 rows of kernels, indentation rough to beaked, ears slightly tapering, grain pearly white. Matures in 120 to 130 days.

Acknowledgment

The writer is greatly indebted to previous investigators with corn at State College and the Branch Stations for the collected data included. Credit is due the writer only for the assembling of these data and the attempt at their interpretation.

To Mr. J. F. O'Kelly, Agronomist, credit is due for planning the experiments for all stations and leading the varietal investigation at State College. At Holly Springs credit is due to Mr. E. B. Ferris, Superintendent, and the late Mr. C. T. Ames for carrying out the work there; at Stoneville, Mr. H. A. York; Raymond, Mr. H. F. Wallace; Natchez, Mr. S. J. Greer; and Poplarville, Dr. J. C. Robert. It is through their efforts that this information is made possible.

AN *Illustrated Guide* TO LANDSCAPING MISSISSIPPI HOMES



by
R. O. MONOSMITH
F. S. BATSON

the road to
Better Living

Bulletin No. 340 December, 1939
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
CLARENCE DORMAN, Director STATE COLLEGE, MISSISSIPPI

ILLUSTRATED GUIDE

TO

LANDSCAPING MISSISSIPPI HOMES

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ILLUSTRATED GUIDE TO LANDSCAPING MISSISSIPPI HOMES

The art of landscaping the home ground can be made profitable to the home owner by increasing the value of the real estate and by making the grounds more convenient, more useful and more attractive. The recreational and educational advantages of landscaping are many, and much may be said regarding the value of orderly, attractive surroundings as an environment for growing children. This bulletin is offered to Mississippians who desire to apply the principles of landscape gardening to their home surroundings.

Organized effort directed by careful forethought and planning is necessary for successful landscape development. Haphazard methods in locating buildings, fences, walks, drives and plantings often wreck permanently the opportunity of ever developing a satisfactory landscape arrangement. The locations of permanent improvements such as buildings and roads should be carefully planned to prevent the necessity for changes in these features.

Gradual development of a simple arrangement, following a plan carefully prepared, is the most desirable method of landscaping the home. Rapid development or complex arrangements are expensive, difficult to maintain and often unsatisfactory.

Remember that the plantings in the landscape picture are never stationary, they are growing and changing from year to year. One should plan to change, revise, replant, replace or thin plants in the original plan.

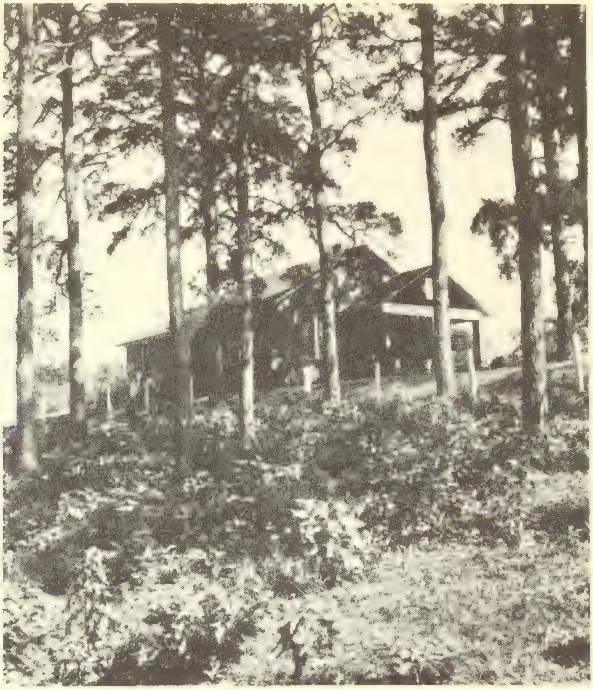


Figure 1

A house site affording desirable setting, drainage, shade and outlook.

STEPS IN LANDSCAPING

There are five major steps to be taken when home grounds are landscaped. These are: 1. Planning; 2. Building according to plan; 3. Grading, fencing and establishing a lawn; 4. Planting trees, shrubs and flowers, according to plan; 5. Maintaining the development by repeated painting and repairing of buildings or fences, mowing, cultivating, pruning, and replacements in plant material.

THE PLAN: The plan is important and is needed to assure success. It does not need to be elaborate or complicated, nor is an expert needed to prepare such a plan. Have you ever drawn the floor plan of a house you have built or intended building? Certainly you have! As have thousands of others. Such simple house plans have guided many architects in house construction. Similarly a "floor plan" of your yard can be prepared that will serve as a blueprint for developing beautiful home grounds.

BUILDING SITES: The first and most important step in planning is the location of buildings whether it be for a town or country home. Home owners frequently forget landscaping in the haste of building and usually regret their lack of foresight. Convenient building arrangement is secured only as a result of careful planning.

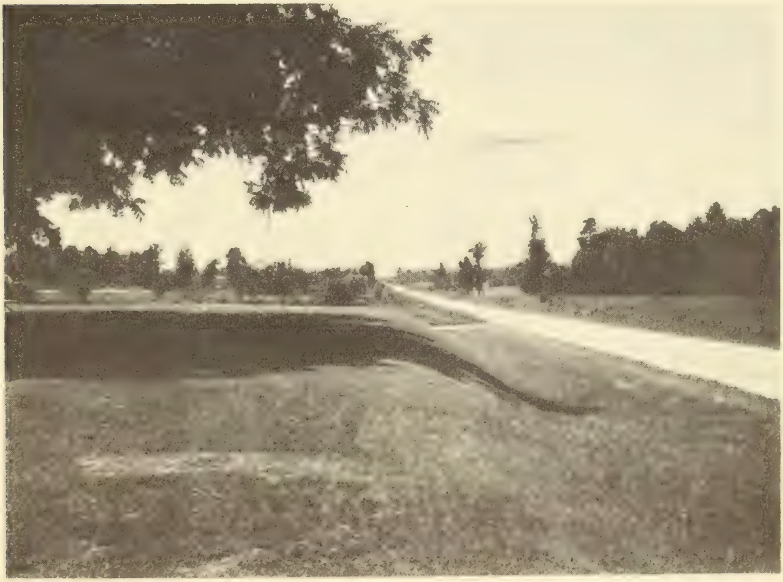


Figure 2

Level lawns, shapely slopes and shifting shadows make a beautiful setting for the home.

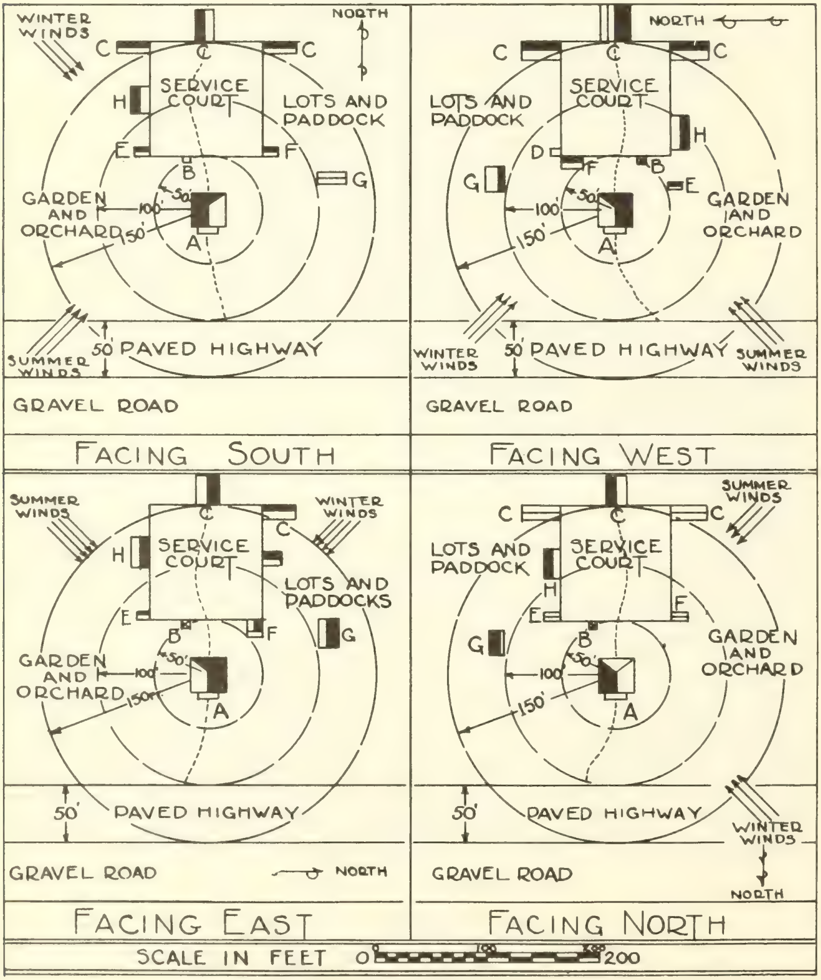
FARMSTEAD ARRANGEMENT

Seek in Farmstead Arrangement:

1. Convenient location of buildings as shown in plan.
2. Proper drainage and sanitation around building and lots.
3. Increased fire protection by correct orientation of buildings.
4. Elimination of odors in the house originating in the barn lot that are carried by prevailing wind by correct barn and lot location.
5. Erosion control by terracing and proper grading and sodding.

Key to Plans

A—Dwelling; B—Well; C—Barns; D—Toilet; E—Smoke House; F—Wood Shed and Wash House; G—Poultry; H—Storage. Symbol .... Water Divide.


WINTER WINDS
NORTH
C
C
C
SERVICE COURT
H
LOTS AND PADDOCK
E
F
B
G
GARDEN AND ORCHARD
50'
100'
150'
A
SUMMER WINDS
50'
PAVED HIGHWAY
GRAVEL ROAD
FACING SOUTH
NORTH
C
C
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150'
A
GARDEN AND ORCHARD
WINTER WINDS
50'
PAVED HIGHWAY
SUMMER WINDS
GRAVEL ROAD
FACING WEST
SUMMER WINDS
C
WINTER WINDS
C
H
SERVICE COURT
LOTS AND PADDOCKS
E
B
F
G
GARDEN AND ORCHARD
50'
100'
150'
A
50'
PAVED HIGHWAY
GRAVEL ROAD
NORTH
FACING EAST
SUMMER WINDS
C
C
C
LOTS AND PADDOCK
SERVICE COURT
H
E
F
B
G
GARDEN AND ORCHARD
50'
100'
150'
A
50'
PAVED HIGHWAY
WINTER WINDS
GRAVEL ROAD
NORTH
FACING NORTH
SCALE IN FEET
0
100
200

Figure 3

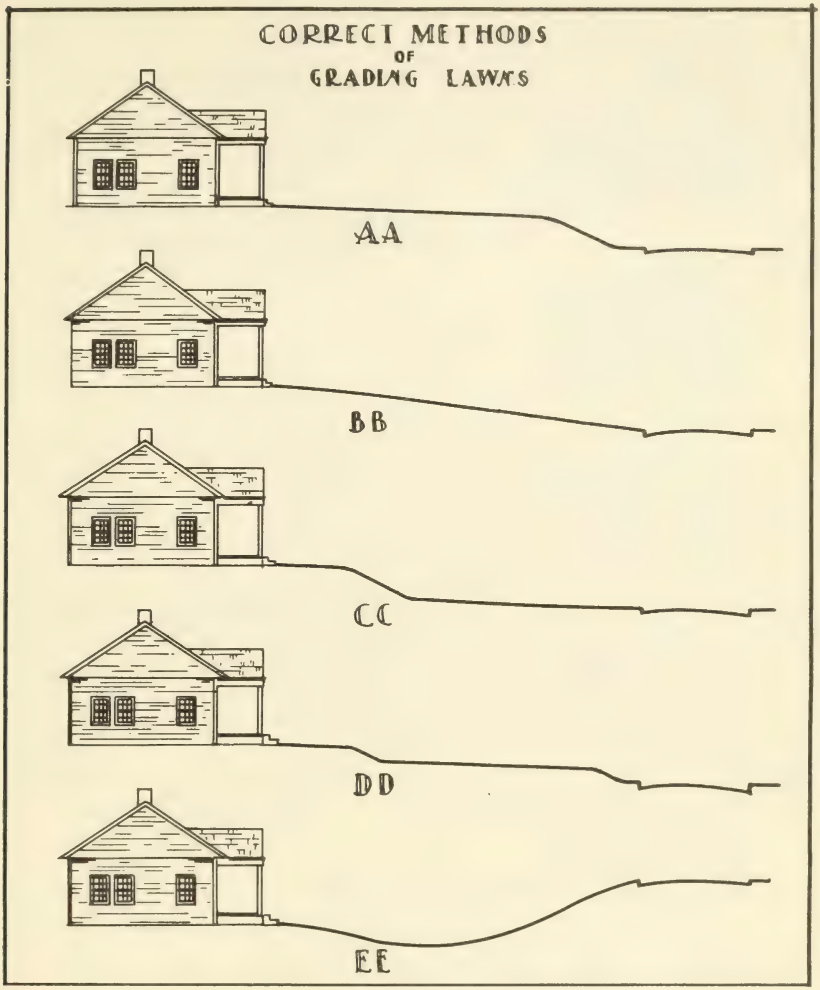


Figure 4

AA. Terrace with 2 to 1 slope (2 feet horizontally to each foot rise in elevation) placed near highway or street.

BB. Lawn sloped gradually from residence to highway or street.

CC. Terrace with 2 to 1 slope placed approximately 20 feet from residence.

DD. One small terrace placed near residence, another near highway or street leaving center of lawn level and open.

EE. Where highway or street is at a higher level than residence, place wide drainage ditch at least 20 to 30 feet from residence if possible.

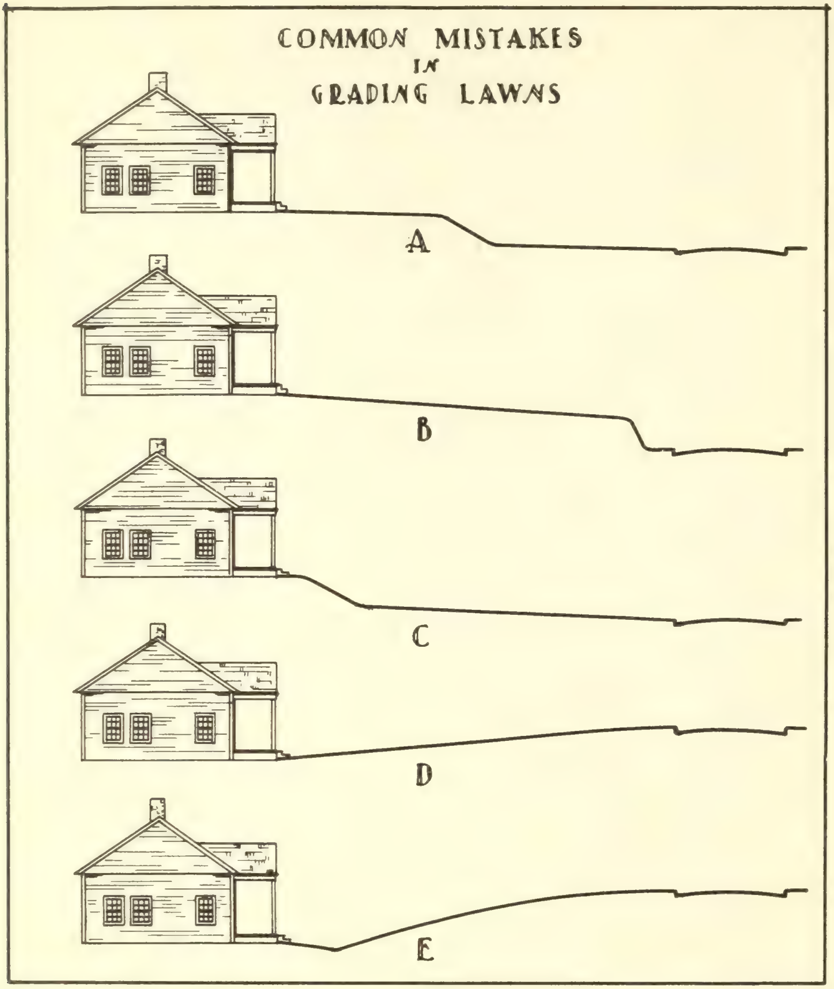


Figure 5

A. Terrace placed in middle of the lawn, thereby breaking expanse of open area and making the lawn appear smaller.

B. Slope of terrace too steep, allowing erosion and making terrace difficult to mow.

C. Terrace placed too near residence not leaving enough space for planting. This often makes a two-story building appear unnecessarily tall.

D. Lawn sloping from highway or street to residence, so that water drains underneath the house.

E. Drainage ditch placed too near residence. See EE opposite page for correct grading.

DRIVES

Drives are built for service. They should be easily accessible from street or highway, direct, with unobstructed views. Convenient turns for exit are desirable and adequate parking space should be provided for both front and rear house entrance. Ten feet should be minimum width of drives. Twelve to 16 foot widths are desirable. The ribbon drive is not recommended. The drive surface should be surfaced with gravel, shell, asphalt, concrete or brick, and a crown and gutter provided for drainage.

See diagrams on page 10. Note drives, walks, and general landscape development.

A. A straight drive offers the most direct route from highway to service area. It is recommended for narrow lots or building sites. This drive does not afford easy exit—its greatest disadvantage. The garage location shown in plan permits easy turning of cars parked in garage and makes a screen planting possible. The drive may be widened 6 or 8 feet for parking at walk junction.

B. Semi-circular drives should be used only on wide level lots or house sites where the house is over 100 feet from the street or highway. It has several advantages—entrance and exit is made more convenient from either direction, passengers can be deposited near the front door, and the semi-circular panel of grass outlined by drive can be made beautiful. Its disadvantages are—expensive construction and unless well maintained it becomes a prominent eyesore. Note junction of semi-circle and service drive.

C. The turn or loop-drive has many variations and when properly arranged can add much to the convenience and beauty of the home grounds. There must be at least 75 feet of space available on service side of house for driveway usage as the outside diameter of the loop or circle must be at least 75 feet for convenient turning of an automobile.

D. A combination of the straight and semi-circular drives with convenient parking space is desirable if sufficient space is available. Satisfactory parking areas are highly desirable yet rarely provided.

E. The drive to a house located on a hill should have a gradual approach. This diagram shows the design of a turn or loop-drive for an elevated house site with the turn convenient to both front and back doors.

F. A formal drive is recommended for colonial homes in the south. The tree lined avenue that makes a direct approach toward the house is terminated by a perfect circle. The diameter of the outside of this circle must be at least 75 feet.

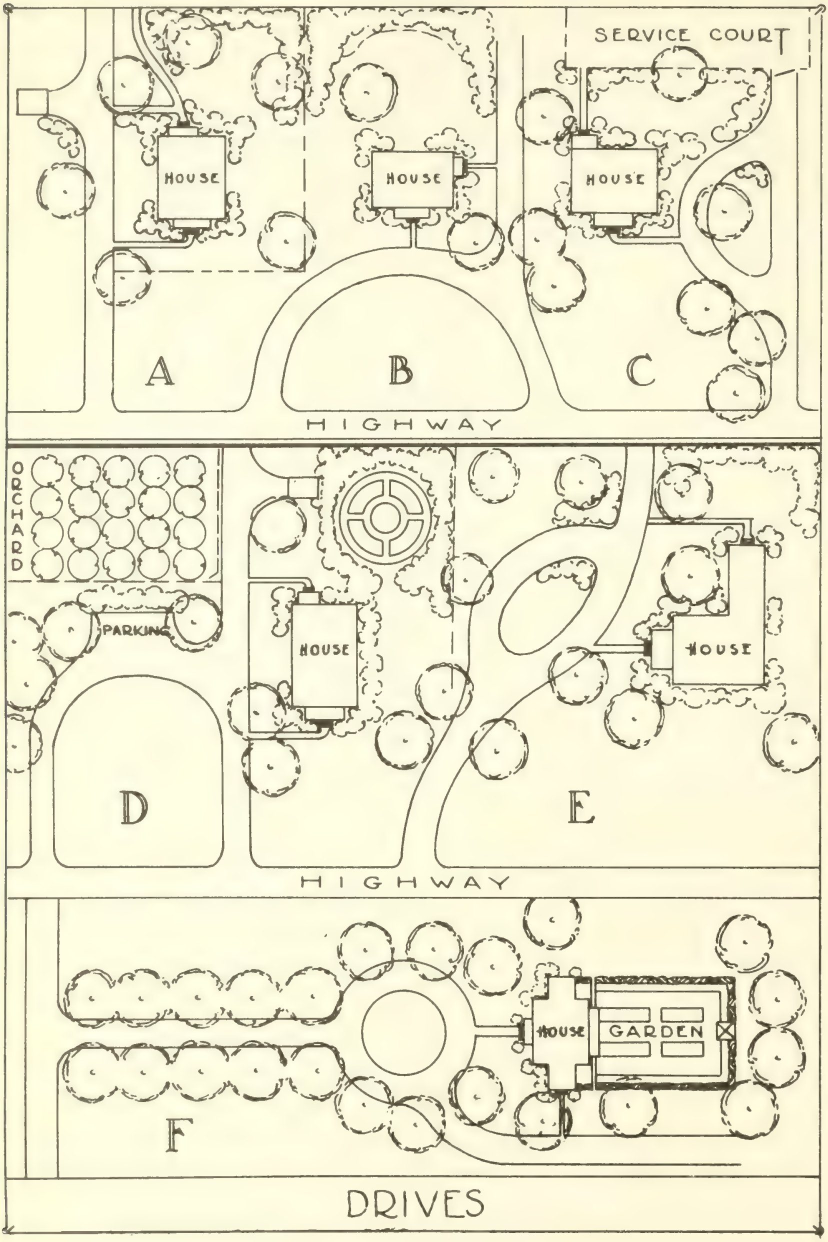

SERVICE COURT
HOUSE
HOUSE
HOUSE
A
B
C
HIGHWAY
ORCHARD
PARKING
HOUSE
HOUSE
D
E
HIGHWAY
HOUSE
GARDEN
F
DRIVES

Figure 6

AREAS

The three major areas of the landscape plan are public, private and service. **The public area** should be arranged to serve the purpose of displaying attractively the home to the passerby and of increasing the pleasure of the public by making every home a beautiful picture. These purposes are fulfilled when the public area consists of a considerable expanse of smooth, unbroken lawn bordered by shrubs and trees planted in irregular groups. An appropriate foundation planting around the base of house completes the setting of the home for public view.

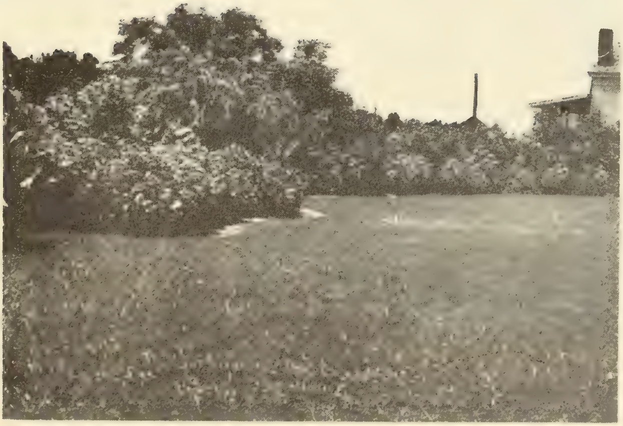


Figure 7

This flowering border of shrubs and annual flowers is serving several purposes. It outlines lawn, screens barn, sheds and service drive and adds a riot of color to the picture.

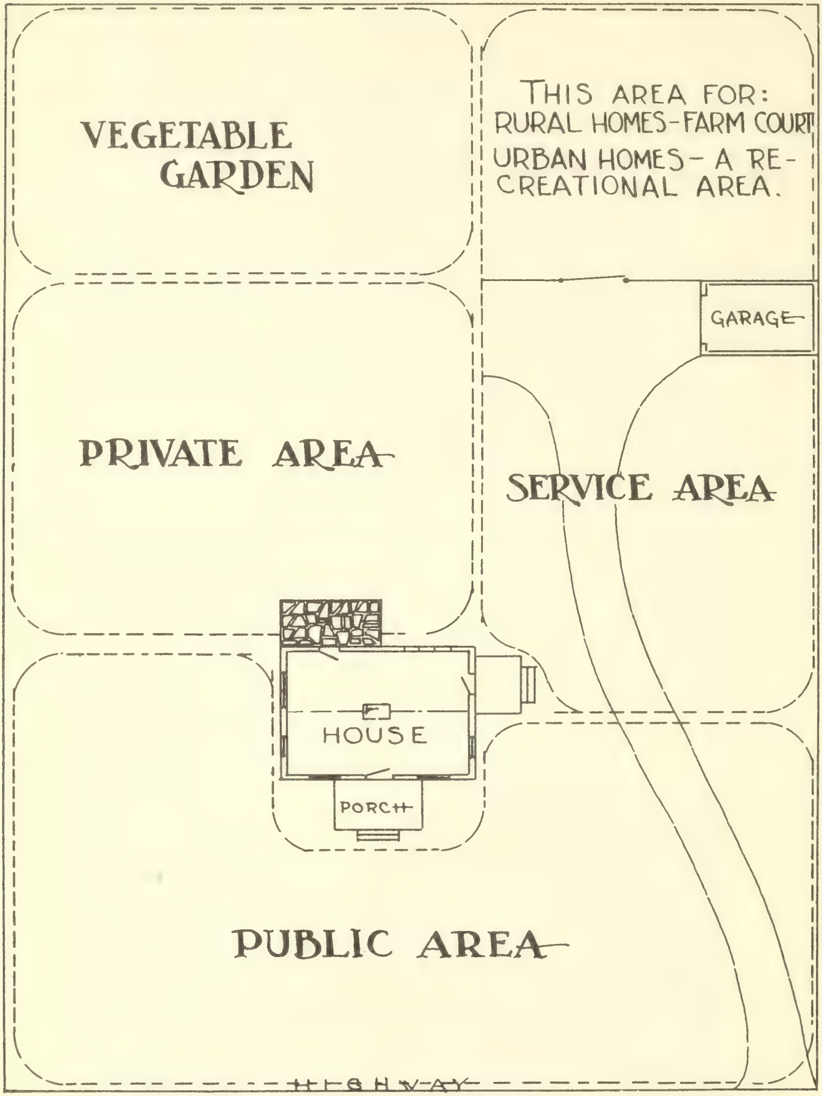

VEGETABLE GARDEN
THIS AREA FOR:
RURAL HOMES-FARM COURT
URBAN HOMES - A RECREATIONAL AREA.
GARAGE
PRIVATE AREA
SERVICE AREA
HOUSE
PORCH
PUBLIC AREA
HIGHWAY

Figure 8

The service area should be screened by plantings or trellis from the public and private areas. This area should be convenient to the kitchen and driveway because it is here that the clothes line, wood pile, and other such objects of domestic need should be located. The service area should be as compact and well planned as the modern kitchen to increase its convenience and usefulness.

The private area can be called the outdoor living room. This part of the grounds should be connected with the living side of the house. It should be screened from public view in order to secure privacy. The enclosure can be made with informal shrub groups or formal hedges, trellises and walls. Informal shrub groups lend themselves to the development of a naturalistic garden which is better adapted to areas larger than 50 feet square. The formal development is better adapted to areas smaller than 50 feet square. This rule is variable and larger areas can be successfully formalized. Shade trees, flowers, arbor, pool, outdoor fireplace, birdbaths and lawn furniture are a few of the features that can be placed in the private area to make the outdoor living room more useful and enjoyable.

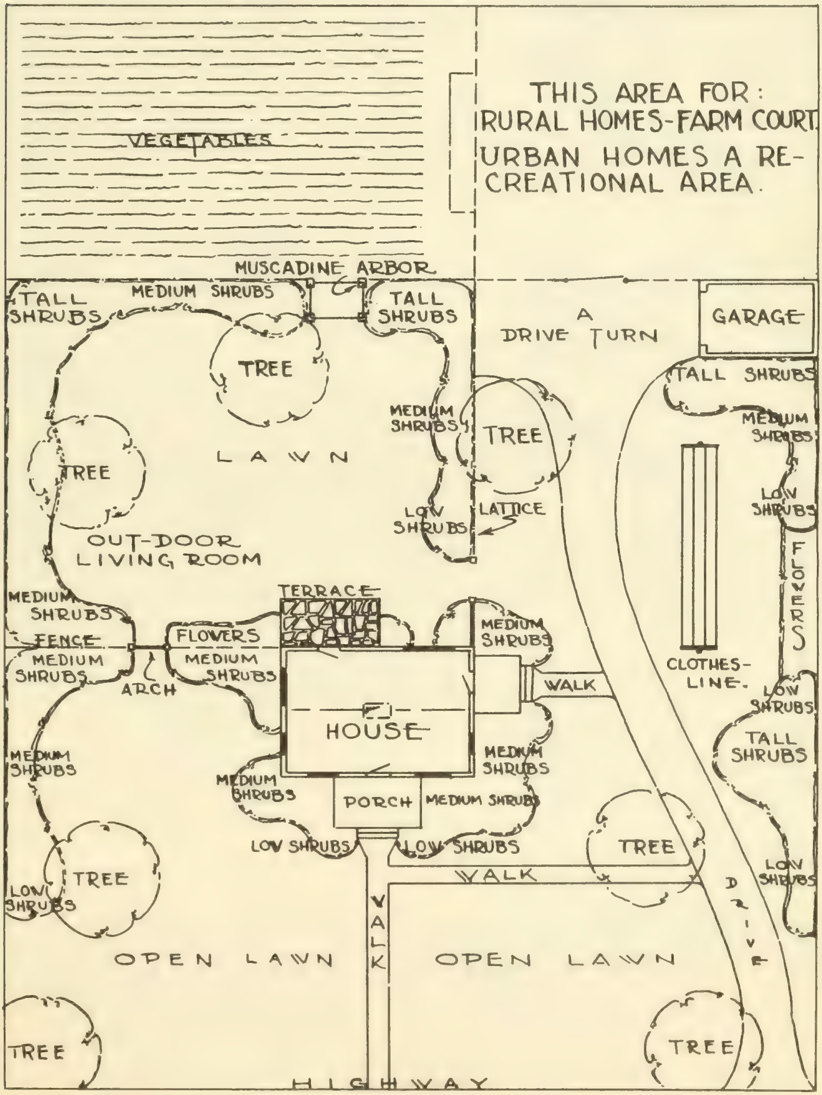

VEGETABLES
THIS AREA FOR:
RURAL HOMES-FARM COURT
URBAN HOMES A RECREATIONAL AREA.
MUSCADINE ARBOR
TALL SHRUBS
MEDIUM SHRUBS
TALL SHRUBS
A DRIVE TURN
GARAGE
TREE
TALL SHRUBS
MEDIUM SHRUBS
MEDIUM SHRUBS
TREE
LAWN
TREE
LOW SHRUBS
LATTICE
LOW SHRUBS
FLOWERS
OUT-DOOR LIVING ROOM
TERRACE
MEDIUM SHRUBS
FENCE
FLOWERS
MEDIUM SHRUBS
MEDIUM SHRUBS
MEDIUM SHRUBS
ARCH
WALK
CLOTHES-LINE.
LOW SHRUBS
HOUSE
TALL SHRUBS
MEDIUM SHRUBS
MEDIUM SHRUBS
MEDIUM SHRUBS
PORCH
MEDIUM SHRUBS
LOW SHRUBS
LOW SHRUBS
TREE
WALK
DRIVE
LOW SHRUBS
LOW SHRUBS
TREE
WALK
OPEN LAWN
OPEN LAWN
TREE
TREE
HIGHWAY

Figure 9

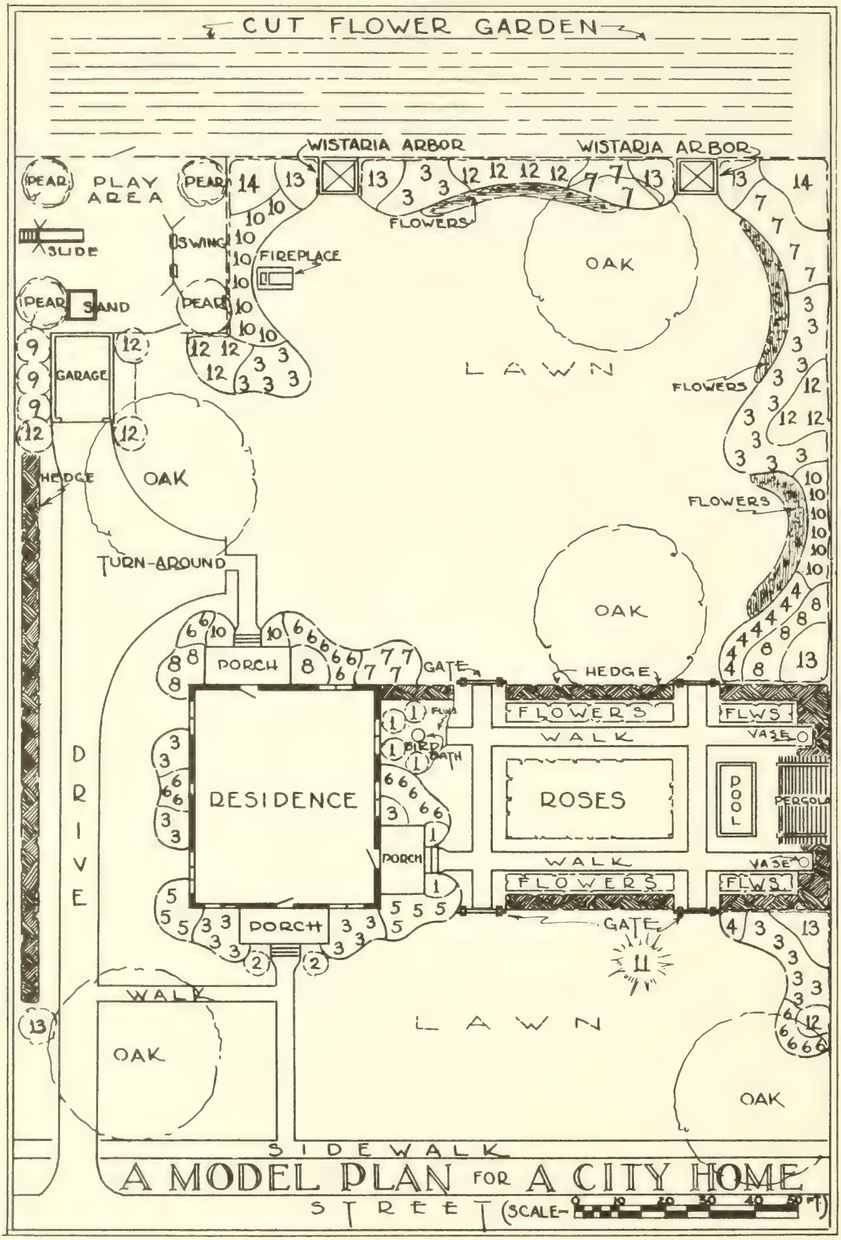

CUT FLOWER GARDEN
WISTARIA ARBOR
WISTARIA ARBOR
PEAR
PLAY AREA
PEAR
SLIDE
SWING
PEAR
SAND
PEAR
FIREPLACE
FLOWERS
OAK
LAWN
FLOWERS
GARAGE
OAK
HEDGE
FLOWERS
TURN-AROUND
OAK
PORCH
GATE
HEDGE
FLWS.
BIRD BATH
FLOWERS
FLWS
VASE
WALK
DRIVE
RESIDENCE
ROSES
POOL
PERGOLA
PORCH
WALK
VASE
FLOWERS
FLWS
PORCH
GATE
WALK
OAK
LAWN
OAK
SIDEWALK
A MODEL PLAN FOR A CITY HOME
STREET
(SCALE- 0 10 20 30 40 50 FT.)

Figure 10

PLANT KEY FOR MODEL PLANS

SOUTH Mississippi

(Meridian, Jackson, Vicksburg and south)

1. **Choice of:**
    - Nandina
    - Boxwood, Dwarf
    - Azalea
    - Laurestinus
    - Holly, Dwarf Japanese
2. **Choice of:**
    - Juniper, Pfitzer
    - Arborvitae, Bonita
3. **Choice of:**
    - Pittosporum
    - Euonymus, Spreading
    - Firethorn, Red Fruited
    - Honeysuckle, Winter
    - Spirea, Vanhout
    - Eleagnus
4. **Choice of:**
    - Rosemary
    - Ardisia
    - Butterfly-Bush
5. **Choice of:**
    - Privet, Glossy
    - Firethorn, Laland
    - Photinia
    - Oleander
    - Camellia
    - Olive, Sweet
    - Pomegranate, Flowering
6. **Choice of:**
    - Jasmine, Winter
    - Jasmine, Everblooming
    - Jasmine, Primrose
    - Spirea, Thunberg
    - Spirea, Anthony Waterer
    - Hydrangea
    - Coral Berry
    - Gall Berry
7. **Choice of:**
    - Pearlbush
    - Althea
    - Mock Orange
8. **Choice of:**
    - Golden-Bell
    - Cape Jasmine
    - Weigela
9. **Choice of:**
    - Cherry Laurel
    - Yew, Japanese

NORTH Mississippi

(North of Meridian, Jackson, Vicksburg line)

1. **Choice of:**
    - Nandina
    - Boxwood, Dwarf
    - Laurestinus
    - Holly, Dwarf Japanese
2. **Choice of:**
    - Juniper, Pfitzer
    - Juniper, Savin
    - Arborvitae, Bonita
3. **Choice of:**
    - Abelia
    - Euonymous, Spreading
    - Firethorn, Red Fruited
    - Honeysuckle, Winter
    - Spirea, Vanhout
    - Eleagnus
4. **Choice of:**
    - Rosemary
    - Butterfly-Bush
5. **Choice of:**
    - Privet, Glossy
    - Firethorn, Laland
    - Photinia
    - Pomegranate, Flowering
6. **Choice of:**
    - Jasmine, Winter
    - Jasmine, Everblooming
    - Jasmine, Primrose
    - Spirea, Thunberg
    - Spirea, Anthony Waterer
    - Hydrangea
    - Coral Berry
7. **Choice of:**
    - Pearlbush
    - Althea
    - Mock Orange
    - Deutzia
8. **Choice of:**
    - Golden-Bell
    - Weigela
9. **Choice of:**
    - Cherry Laurel
    - Cedar, Cannart

South Mississippi—Cont'd.

10. Choice of:

Quince, Flowering
Almond, Flowering
Honeysuckle, Pink

11. Choice of:

Deodar Cedar
Cedar, Silver Red
Fir, Chinese
Holly, American

12. Choice of:

Privet, Japanese
Privet, Chinese
Crape Myrtle
Bamboo
Huckleberry

13. Choice of:

Dogwood
Red Bud

14. Choice of:

Mimosa
Weeping Willow

North Mississippi—Cont'd.

10. Choice of:

Quince, Flowering
Almond, Flowering

11. Choice of:

Deodar Cedar
Cedar, Silver Red
Cedar, Red
Holly, American

12. Choice of:

Privet, Japanese
Privet, Chinese
Crape Myrtle

13. Choice of:

Dogwood
Red Bud

14. Choice of:

Mimosa
Weeping Willow

NOTE: See tables in back of bulletin for botanical name and descriptions of these plants.

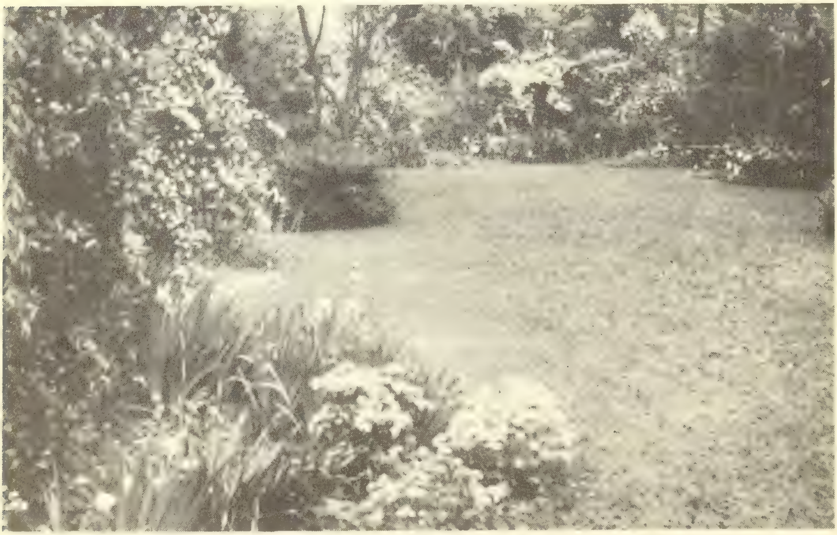


Figure 11

Informal garden. Note smooth lawn and irregular points and bays of border planting, also the use of herbaceous perennials along the front of shrub border.

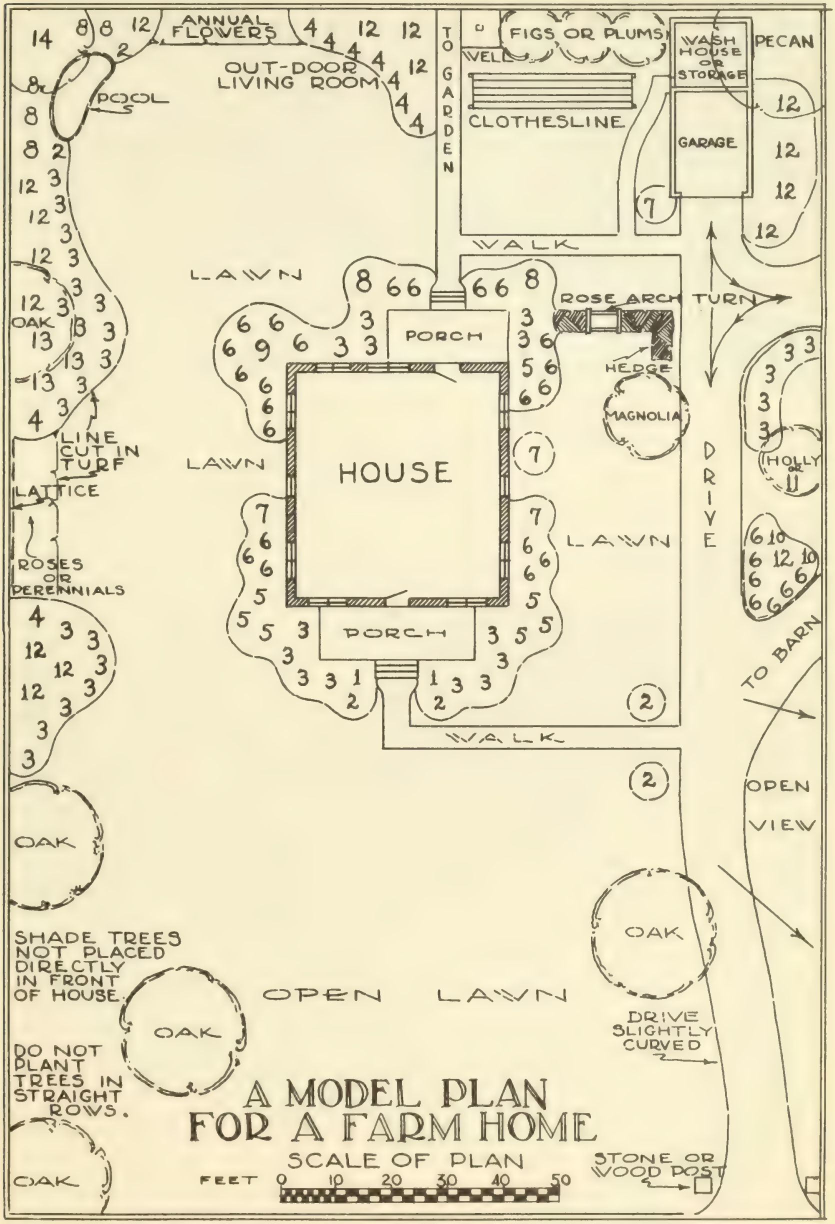

ANNUAL FLOWERS
OUT-DOOR LIVING ROOM
POOL
TO GARDEN
WELL
FIGS OR PLUMS
WASH HOUSE OR STORAGE
PECAN
CLOTHESLINE
GARAGE
WALK
LAWN
PORCH
ROSE ARCH
TURN
HEDGE
MAGNOLIA
OAK
HOUSE
LINE CUT IN TURF
LATTICE
ROSES OR PERENNIALS
DRIVE
HOLLY OR 11
LAWN
PORCH
WALK
TO BARN
OPEN VIEW
OAK
SHADE TREES NOT PLACED DIRECTLY IN FRONT OF HOUSE.
OAK
OPEN LAWN
DRIVE SLIGHTLY CURVED
DO NOT PLANT TREES IN STRAIGHT ROWS.
A MODEL PLAN FOR A FARM HOME
SCALE OF PLAN
FEET 0 10 20 30 40 50
STONE OR WOOD POST
OAK

Figure 12

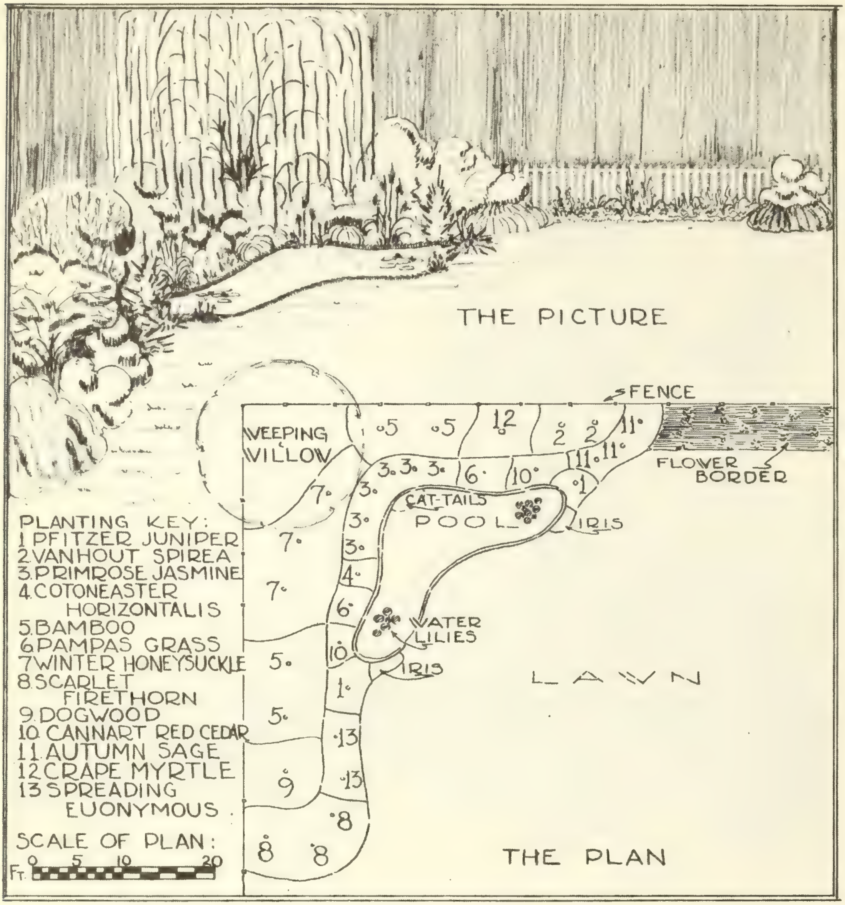

THE PICTURE
FENCE
WEEPING WILLOW
5
5
12
2
2
11
11
11
3
3
3
6
10
1
7
3
3
CAT-TAILS
POOL
IRIS
FLOWER BORDER
7
3
7
4
6
WATER LILIES
10
5
IRIS
LAWN
1
5
13
9
13
8
8
8
THE PLAN
PLANTING KEY:
1 PFITZER JUNIPER
2 VANHOUT SPIREA
3 PRIMROSE JASMINE
4 COTONEASTER HORIZONTALIS
5 BAMBOO
6 PAMPAS GRASS
7 WINTER HONEYSUCKLE
8 SCARLET FIRETHORN
9 DOGWOOD
10 CANNART RED CEDAR
11 AUTUMN SAGE
12 CRAPE MYRTLE
13 SPREADING EUONYMOUS
SCALE OF PLAN:
FT. 0 5 10 20

Figure 13

IMPORTANT POINTS IN POOL PLANNING

1. Locate pool where it will receive abundant sunshine.
2. Lawn and garden conditions usually require the construction of a concrete basin. This basin may take an informal shape resembling the natural pond or a formal shape such as the round, rectangular or square pool.
3. Larger pools should be 24 to 30 inches in depth to allow 8 to 12 inches of good soil and a sufficient depth of water for plant growth.
4. A naturalistic pool must have an appropriate setting of plants that will provide background for the pool.
5. A formal pool is placed in open lawn areas. Such lawn areas are usually bordered by hedges, walls or fences built on lines conforming to the lines of the pool.
6. Do not hide pool by placing plants in front of it.
7. The rim of the pool should be low and inconspicuous blending into the lawn. Irregular and jagged rocks placed upright around pool are undesirable.
8. Mirror-like, open water surface for reflections is desirable. Do not fill the entire pool with lily pads.

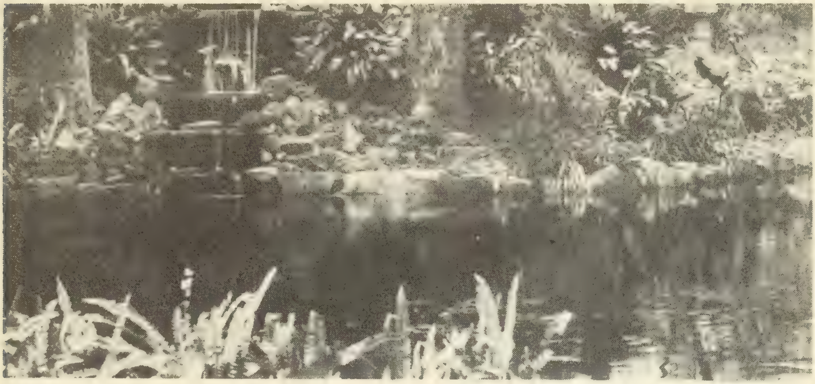


Figure 14

An informal pool built at the foot of a slope showing a well constructed waterfall.

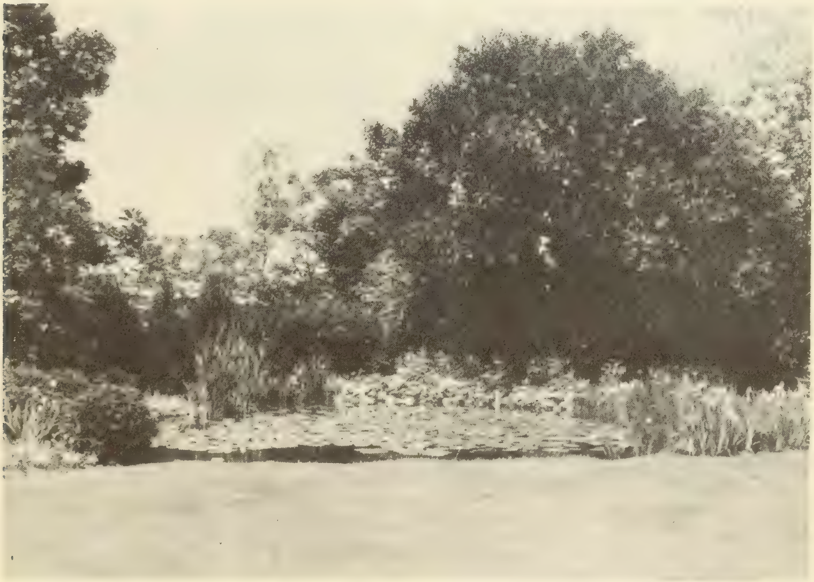


Figure 15

An informal pool built at the edge of a level lawn. Note unobstructed view of pool and smooth blending of grass and water. This pool is correctly framed by water plants, perennials and low shrubs. The background of small trees makes this a pool worthy of study.

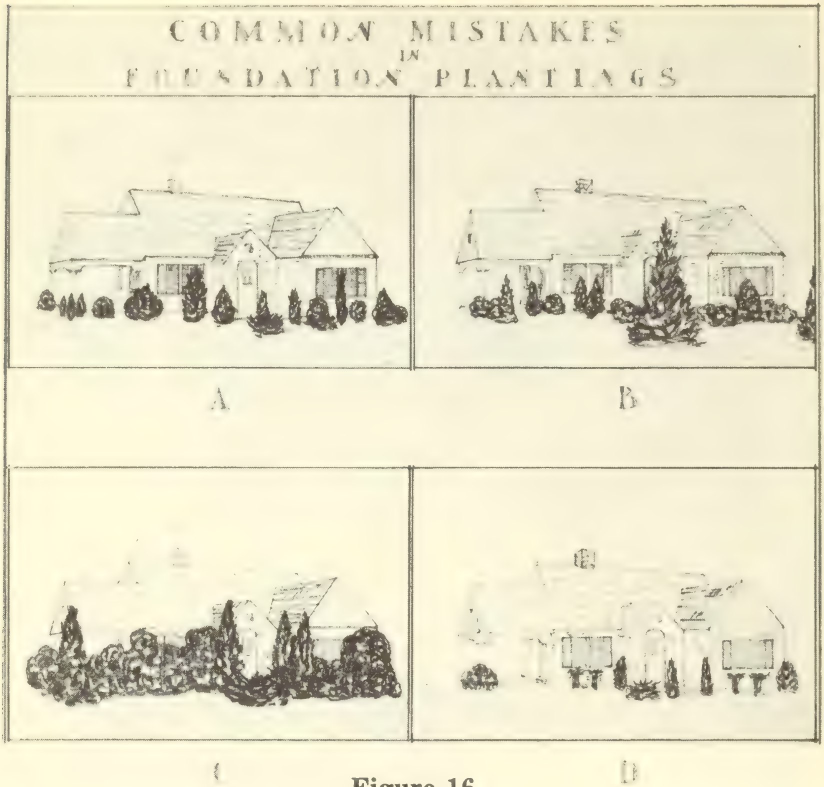


Figure 16

A. Plants used in this planting have too much variation in shape of individual plants, hence do not lend themselves well to grouping. Blending of individual plant with other plants in the group is necessary for most effective foundation plantings.

B. Accent plants should be placed at points of accent of the building, as at entrances, corners, ends and other vertical lines of building. Specimen plants should never be placed in the lawn to break expanse of this open area.

C. Over planting is a common mistake. Large heavy planting prevents free air circulation, shuts out sunlight and hides most of the architecture of the building. A new planting of low growing shrubs is usually necessary to correct permanently this mistake. Heavy frequent pruning can temporarily correct this situation when original planting is composed of deciduous or large broadleaf evergreen shrubs.

D. Scattered planting does not give the necessary mass effect that is desirable in a foundation planting. See opposite page for more desirable foundation planting.

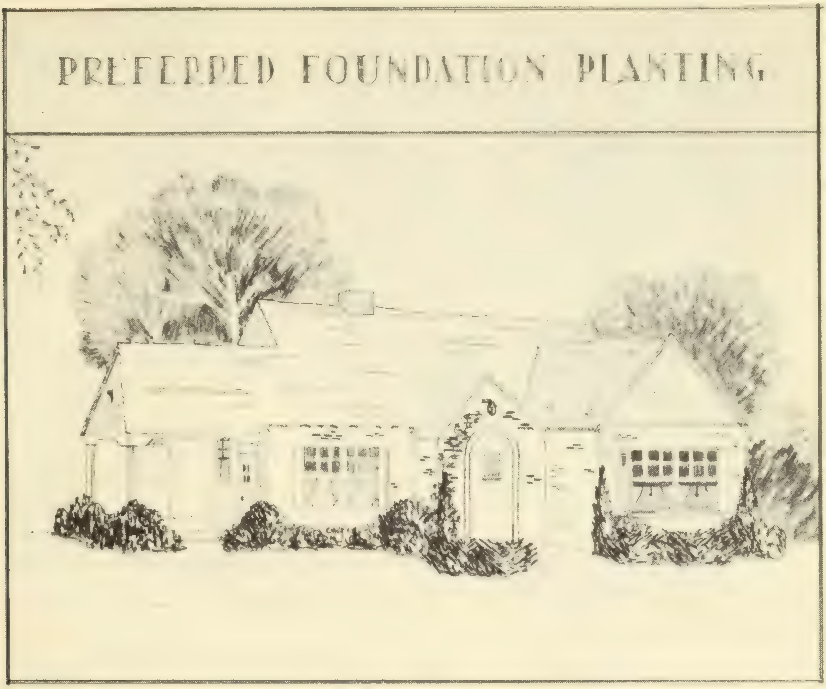


Figure 17

Foundation planting, or base planting, on the home grounds is to many home owners the most important part of the home landscaping. Certainly such planting correctly done enhances the beauty of a residence, but careful planning is necessary. Each home presents a different problem because of difference in architecture, topography and size of area and because of individual preferences of the home owner. The following are a few rules which may be applied in the planting of most homes.

1. Use shrubs small to medium in size when mature. The foundation planting should not hide attractive features of the house, but should furnish a setting by tying the house to the ground and softening hard lines.

2. Plant shrubs in groups or masses using three, five, or more plants of the same kind in each group. A large variety of plants is not desirable, but at least a few plants which give variation in foliage or bloom during the year should be used. An entire planting of narrowleaf evergreens often become monotonous because of their sameness throughout the year.

3. Group plants of approximately equal vigor together so that each will be able to compete with the other.

4. Where a mixed planting of evergreens and deciduous plants is used it is usually desirable to place evergreens near the entrance to add refinement.

5. Use accent plants sparingly, such as arborvitaes or upright junipers. These plants should be placed at entrances, corners and extremeties of building.

6. Continuous planting around the entire house is not always desirable unless the foundation is high and ugly. It is usually desirable to allow the lawn to meet the foundation of the house in several places. This creates the impression of stability and eliminates the feeling that the house is resting on a mass of shrubs.

7. Unless very small plants are used, place inner ones of planting at least 4 feet from the base of the house. Give plants adequate room for growth.

8. The front outline of the shrub bed should be gently curved—not square or rectangular in shape. Avoid setting plants in straight rows. They should be staggered.

9. In most instances a foundation planting is more effective where herbaceous annuals and perennials are not mixed with shrubs or placed in beds in front of them. Such plants are sometimes used alone effectively as a foundation planting for very low houses if the beds are properly maintained.

10. Plan to replace most of the plants in the foundation planting every 8 to 12 years for most satisfactory results.

PLANTINGS FOR SHADY PLACES

"What plants will grow in the shade?" is a question frequently asked in Mississippi. This question is answered in the diagrams on opposite page.

The shade problem is frequently created by an over planting of trees that are located too close to the house. Allow the trees to remain if a dense shade is more desired than lawn, shrubs and flowers about the house. Thin the trees if a good landscape effect is desired, leaving them 50 feet apart and none closer than 50 feet to the house. Perhaps one or two trees could be left on the south and west sides of the house, at a distance of 25 to 35 feet.

Tree roots take much of the moisture and plant food from the soil. Root competition is more often a cause of shrub failure under trees than is shade. There are a few shrubs that will grow moderately well under oak trees, but practically none succeed under closely planted pecans and elms. The shrubs that will grow under oaks are shown with arrangement and spacing for a foundation planting in diagram on opposite page entitled "A Shaded House."

There are several shrubs that thrive in shady situations on the north side of buildings. These are appropriately grouped in a planting entitled "North Side of House" in diagram on opposite page.

Several native shrubs grow well in the shade of trees. These are correctly grouped with other flowering shrubs in diagram on opposite page entitled "A Shaded Border."

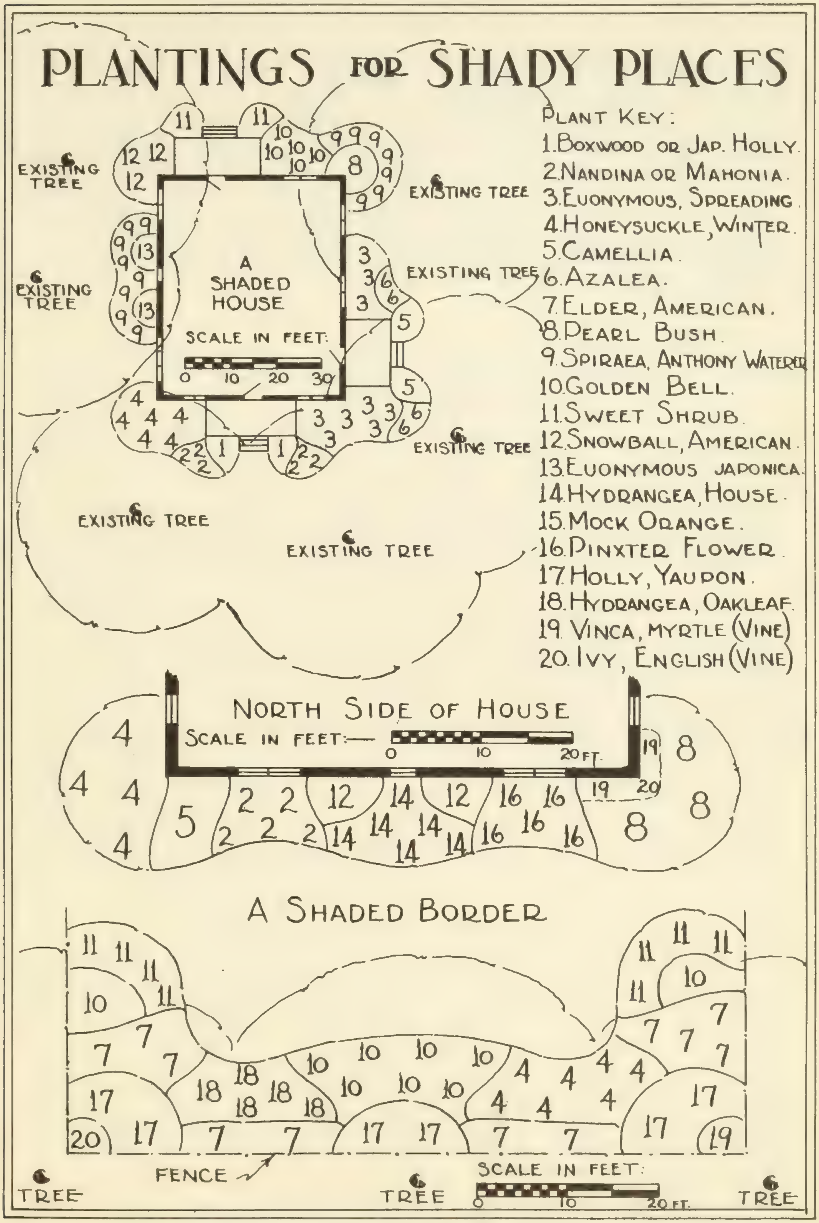

PLANTINGS FOR SHADY PLACES
PLANT KEY:
1. Boxwood or Jap. Holly.
2. Nandina or Mahonia.
3. Euonymous, Spreading.
4. Honeysuckle, Winter.
5. Camellia.
6. Azalea.
7. Elder, American.
8. Pearl Bush.
9. Spiraea, Anthony Waterer
10. Golden Bell.
11. Sweet Shrub.
12. Snowball, American.
13. Euonymous japonica.
14. Hydrangea, House.
15. Mock Orange.
16. Pinxter Flower.
17. Holly, Yaupon.
18. Hydrangea, Oakleaf.
19. Vinca, myrtle (Vine)
20. Ivy, English (Vine)
A SHADED HOUSE
SCALE IN FEET:
0
10
20
30
EXISTING TREE
EXISTING TREE
EXISTING TREE
EXISTING TREE
EXISTING TREE
EXISTING TREE
EXISTING TREE
NORTH SIDE OF HOUSE
SCALE IN FEET:—
0
10
20 FT.
A SHADED BORDER
FENCE
TREE
TREE
TREE
SCALE IN FEET:
0
10
20 FT.

Figure 18

FORMAL GARDENS

As population increases home grounds become smaller. This is particularly true in towns and cities where lots are small and space for private grounds must be confined to small areas which are usually square or rectangular. Since formal garden design is well adapted to small areas, it is often desirable to use formal design on the home grounds.

Although rules for design of formal gardens are not obligatory, it is usually advantageous, particularly for the beginner, to apply the following formulas:

DESIGN OF THE RADIAL GARDEN

(See plans opposite page)

1. Any space to be developed as a formal garden according to the radial formula should be level.
2. The area should be small. A circular rose garden with a 12 foot radius is satisfactory for the private home. In most instances the radius should be less than 50 feet.
3. The area to be treated should be round or square in most cases.
4. The garden should be entirely enclosed by hedges, shrubs, lattice, walls, buildings or combinations of these elements.
5. The main interest must be at the center of the garden. The marginal treatment should not include effects which compete with the central feature. Entrance gates are points of danger, since these may be made too prominent.
6. Paths are laid out as radii from the center. Their width is governed, as far as possible, by the size of the garden. These paths should be of uniform width—not becoming narrower toward the center of the garden. They may be of grass, gravel, brick or paving stones.
7. The size of the garden will determine whether or not it is suitable to have terminating features at points where the walks intersect the garden boundary. In a large garden simple termini or features are needed but they must be kept distinctly subordinate to the chief feature occupying the center of the garden.
8. The marginal features at the ends of the walks may be seats, vases, bird houses, small formal shrubs, or other objects of similar value. The entrances to the garden often may be made more attractive by simple gates or arches.
9. Flower beds, when introduced, are placed between the radiating walks. These should conform strictly to the structural lines of the garden. It is often worthwhile to leave some open space, especially about the center, to emphasize the general garden structure or to exhibit to greater advantage the commanding central feature.

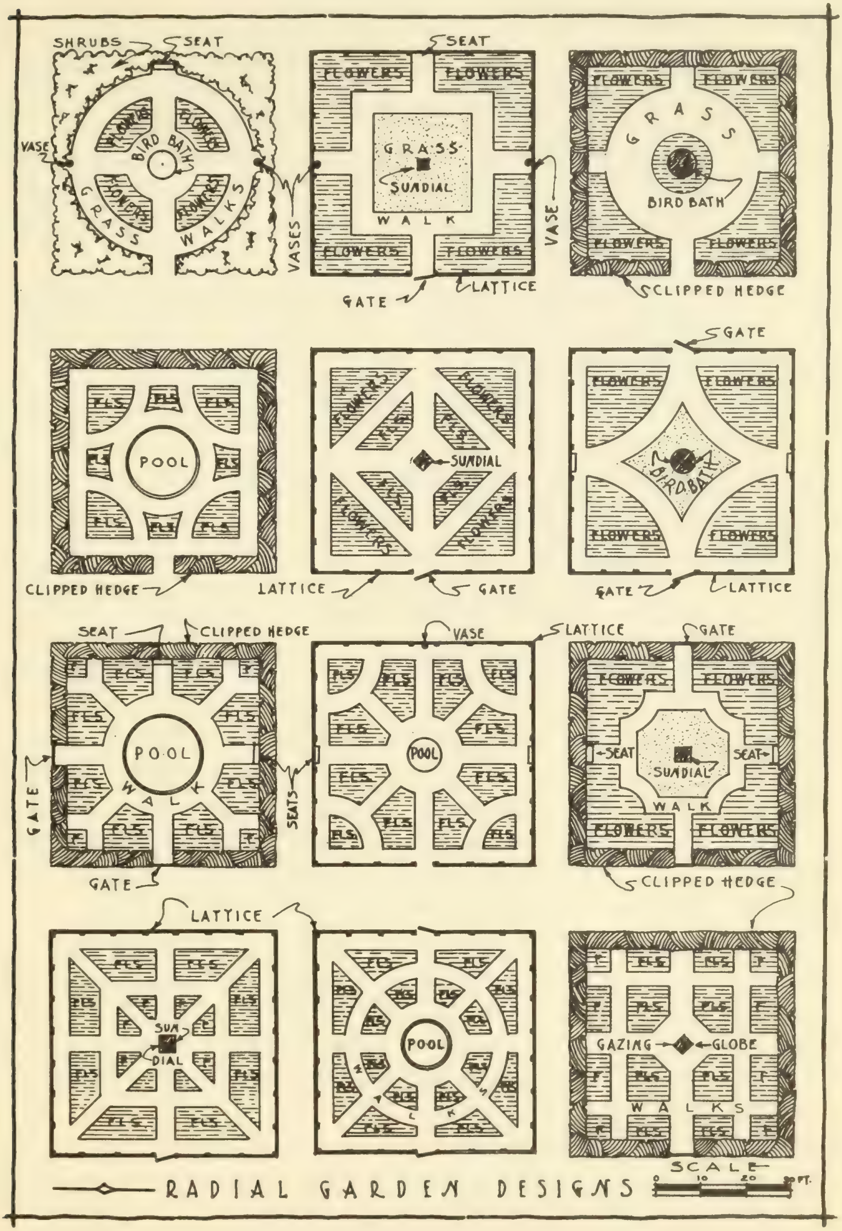

SHRUBS
SEAT
VASE
BIRD BATH
FLOWERS
GRASS WALKS
VASES
SEAT
FLOWERS
GRASS
SUNDIAL
WALK
VASE
GATE
LATTICE
GRASS
BIRD BATH
CLIPPED HEDGE
POOL
FLS
CLIPPED HEDGE
SUNDIAL
LATTICE
GATE
GATE
BIRD BATH
GATE
LATTICE
SEAT
CLIPPED HEDGE
POOL
WALK
GATE
SEATS
VASE
LATTICE
POOL
GATE
SEAT
SUNDIAL
SEAT
CLIPPED HEDGE
LATTICE
SUN DIAL
POOL
WALK
GAZING GLOBE
WALKS
RADIAL GARDEN DESIGNS
SCALE
0
10
20
30 FT.

Figure 19

RECTANGULAR FORMAL GARDEN DESIGN

(See illustrations opposite page)

1. Formal gardening should be attempted only on relatively small areas. For the ordinary family garden one-fourth to one-half acre would be the maximum allowance. Best results are usually secured on areas considerably smaller.
2. The area should be rectangular or as nearly rectangular as possible. Usually irregular areas easily may be reduced to rectangular forms.
3. The area should be level or as nearly level as possible. Where it slopes distinctly it should be brought to two or more levels by terracing.
4. The formal garden should be wholly and distinctly enclosed by buildings, walls, hedges, shrubs or fences.
5. In this rectangular space no definite proportion between length and breadth is necessary, but best results can usually be secured with a ratio about 7:5 or 8:5.
6. See diagrams on opposite page for suggestions on walk or axis treatment.
7. At the end of each walk or axis there must be provided a suitable feature.
8. These features must be objects of definite interest and beauty. Those features most commonly employed are fountains, bird baths, sun dials, gazing globes, seats, arbors, pergolas, statues, tea houses and small buildings.
9. These terminal features must be carefully proportioned in size and interest to the length and importance of the axis on which they are placed. The height of the terminal features may be approximately 10 per cent of the total length of the axis. Features on the major axis must be distincly larger and more interesting than those on the minor axis.
10. The intersections of walks or axis may sometimes be marked by pools. Pools in this position are attractive on account of the reflections they offer toward the principal points of view.
11. The center of the garden should often be left open.

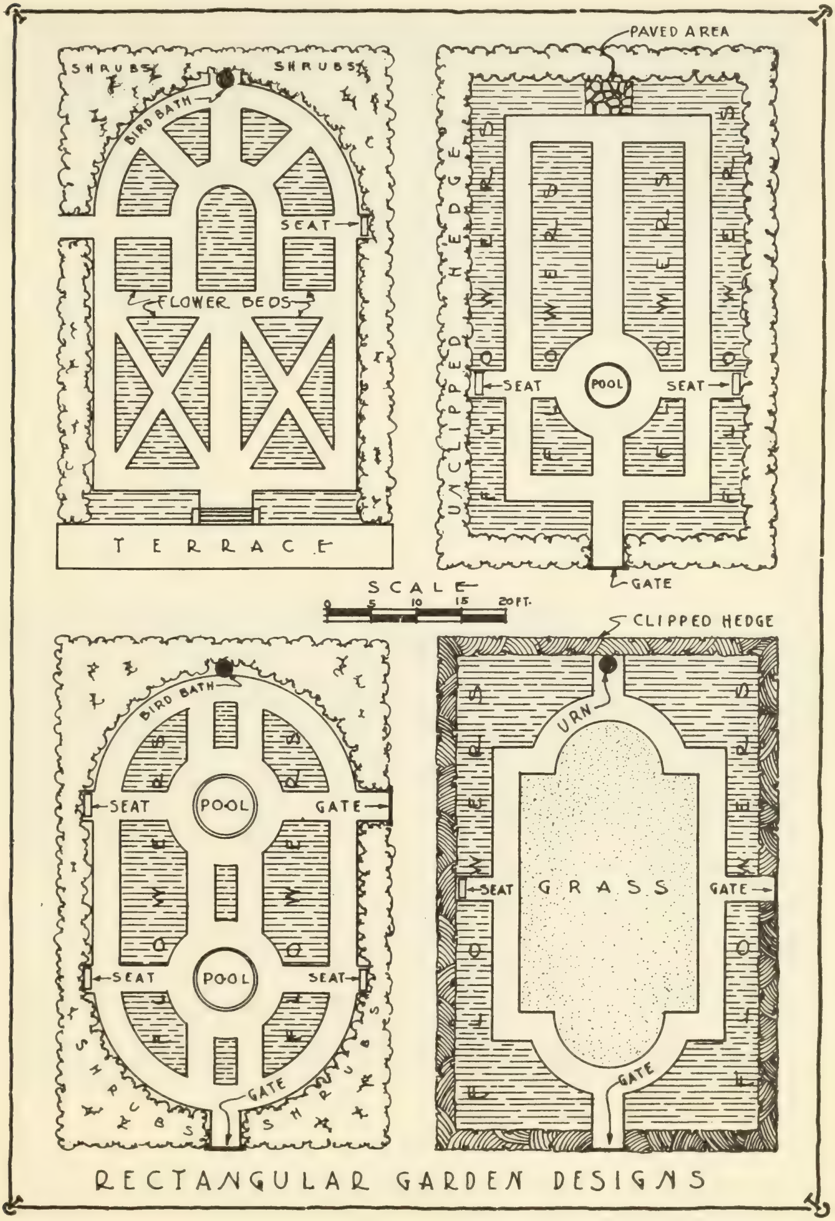

SHRUBS
SHRUBS
BIRD BATH
SEAT
FLOWER BEDS
TERRACE
PAVED AREA
UNCLIPPED HEDGE
FLOWER BED
SEAT
POOL
SEAT
GATE
SCALE
0 5 10 15 20 FT.
CLIPPED HEDGE
BIRD BATH
SEAT
POOL
GATE
SEAT
POOL
SEAT
SHRUBS
GATE
SHRUBS
URN
SEAT
GRASS
GATE
GATE
RECTANGULAR GARDEN DESIGNS

Figure 20

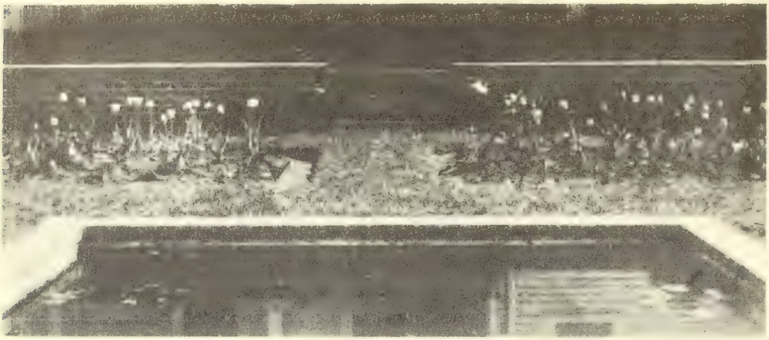


Figure 21

A formal pool occupying small area of yard closely associated with the house. The low brick wall and steps make appropriate setting for formal flower beds and pool. Note close tie-up between house and garden.

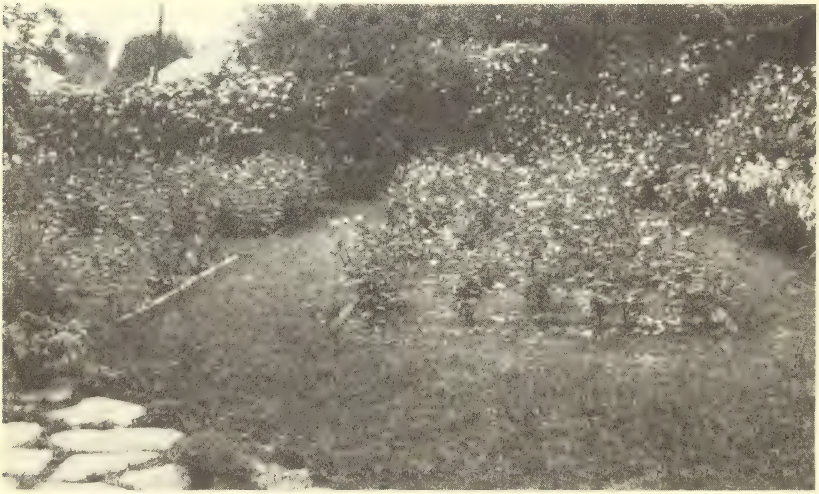


Figure 22

A rose garden. Rose culture demands regular plant spacing, open unshaded areas, and clean cultivation. These conditions are most successfully secured in rectangular shaped beds such as illustrated here. Note the smooth grass walks, low brick edging around beds, and flowering border of climbing roses and iris.

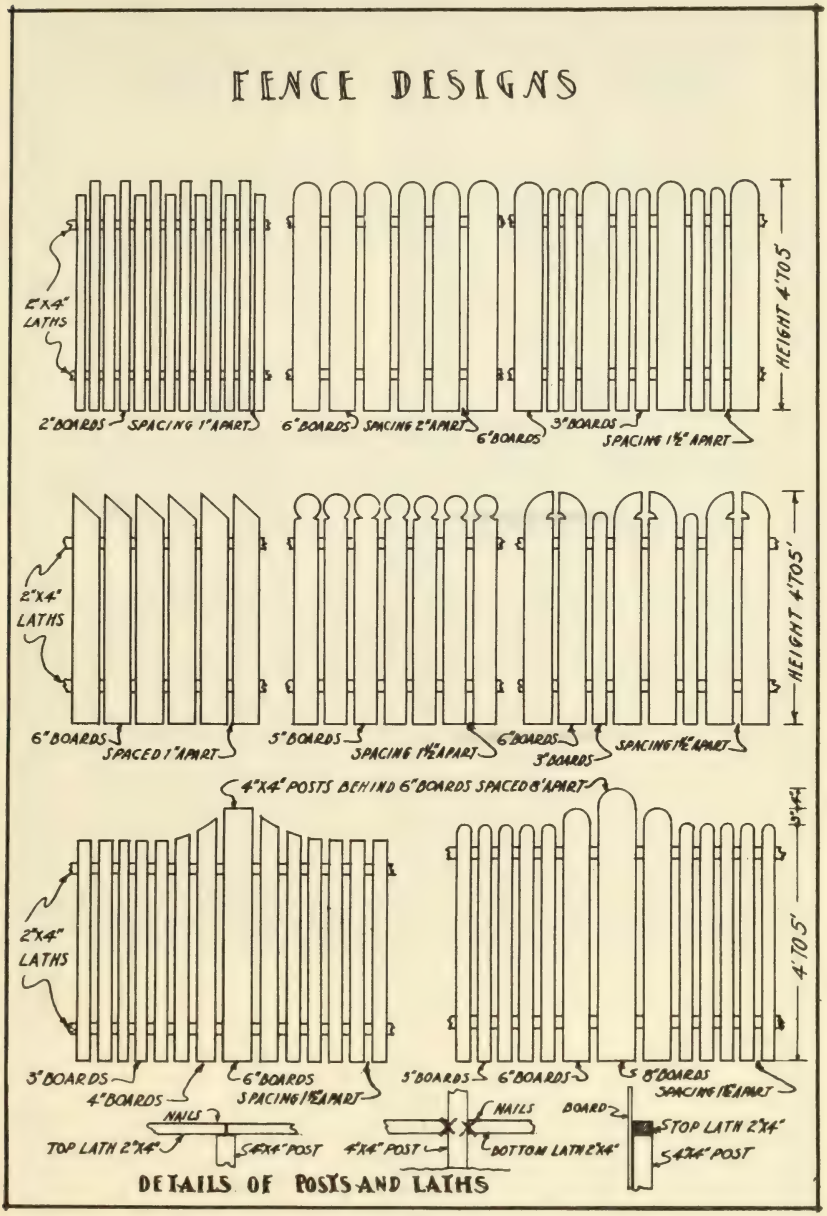

FENCE DESIGNS
2"X4" LATHS
2" BOARDS
SPACING 1" APART
6" BOARDS
SPACING 2" APART
6" BOARDS
3" BOARDS
SPACING 1½" APART
HEIGHT 4' TO 5'
2"X4" LATHS
6" BOARDS
SPACED 1" APART
5" BOARDS
SPACING 1½" APART
6" BOARDS
3" BOARDS
SPACING 1½" APART
HEIGHT 4' TO 5'
4"X4" POSTS BEHIND 6" BOARDS SPACED 8' APART
2"X4" LATHS
3" BOARDS
4" BOARDS
6" BOARDS
SPACING 1½" APART
5" BOARDS
6" BOARDS
8" BOARDS
SPACING 1½" APART
4' TO 5'
NAILS
TOP LATH 2"X4"
4"X4" POST
4"X4" POST
NAILS
BOTTOM LATH 2"X4"
BOARD
STOP LATH 2"X4"
4"X4" POST
DETAILS OF POSTS AND LATHS

Figure 23

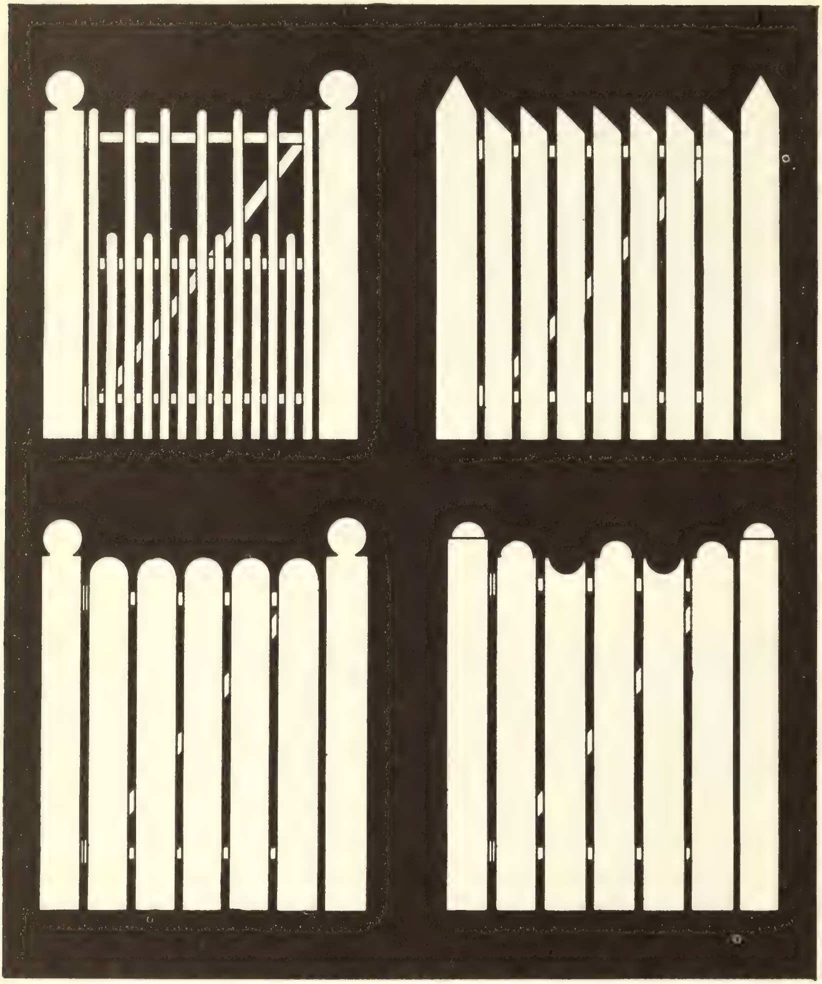


Figure 24

GATES AND TRELLISES

Gates may be made focal points of interest on the home grounds. The doorway of a house is frequently one of the most attractive parts of its architectural structure. The gateway to the garden is relatively as important. Exercise care in selecting a design for the gate that suits a particular situation. The fence design should determine largely the design of the gate. See page 29 for fence designs.

Interest will be added to the different areas of the yard if several gates are used, having a gateway separating each area. This arrangement gives the feeling that one is entering or leaving a definite area. Vines or roses growing on gates add to their beauty.

Trellises are tall latticed supports for vines, or roses and should be considered in connection with gates or other substantial structures. A trellis should be used for ornament or screening and may be substituted for the picket fence. Its height and light construction makes it necessary that trellises be connected with gates, arbors, heavy end posts or the corners of buildings.

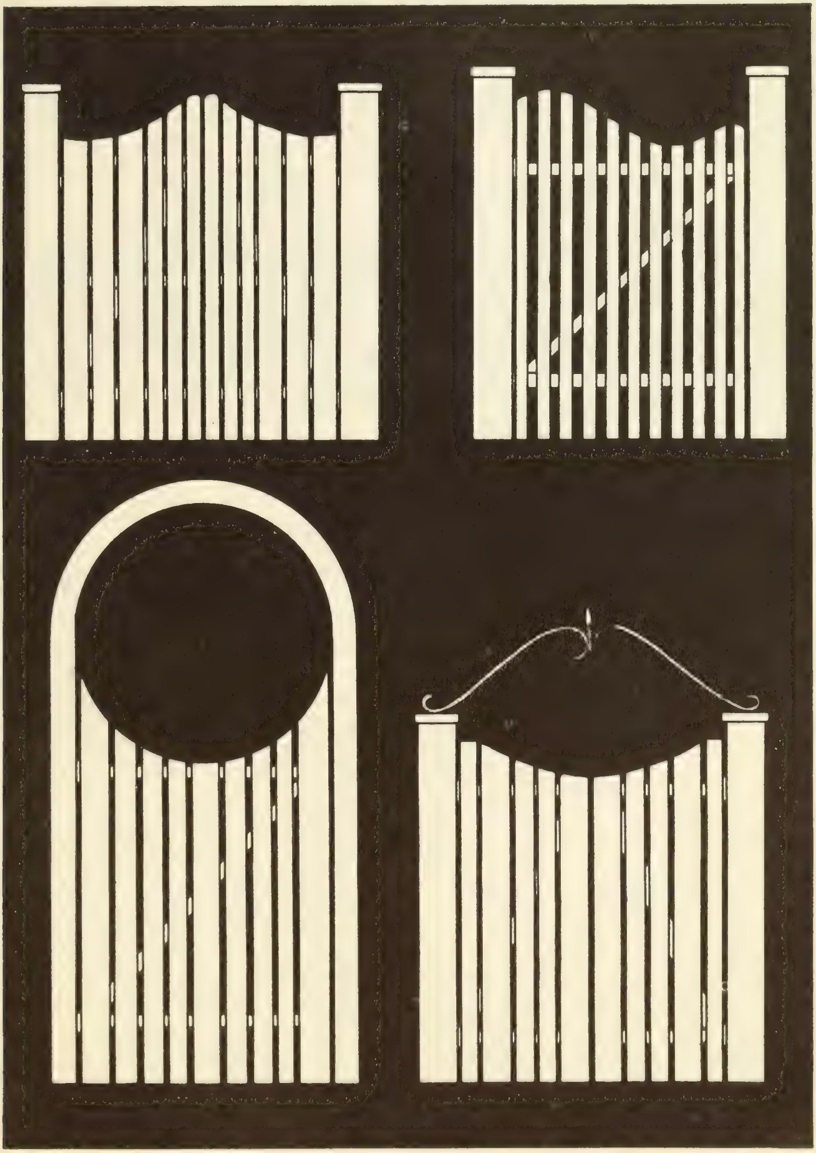


Figure 25

WALKS

Walks are strictly utility features, but the lines of properly located walks add much to the landscape design.

1. **Walk location**—Convenient and direct, either straight or slightly curved to avoid obstructions or follow slope of land.
2. **Walk width** — Two feet of width for each person. Four foot walks usually most serviceable.
3. **Walk materials** — Concrete, brick or flagstone from street or drive to entrance. In gardens use brick, stepping stone, gravel, flagstone or thick turf.

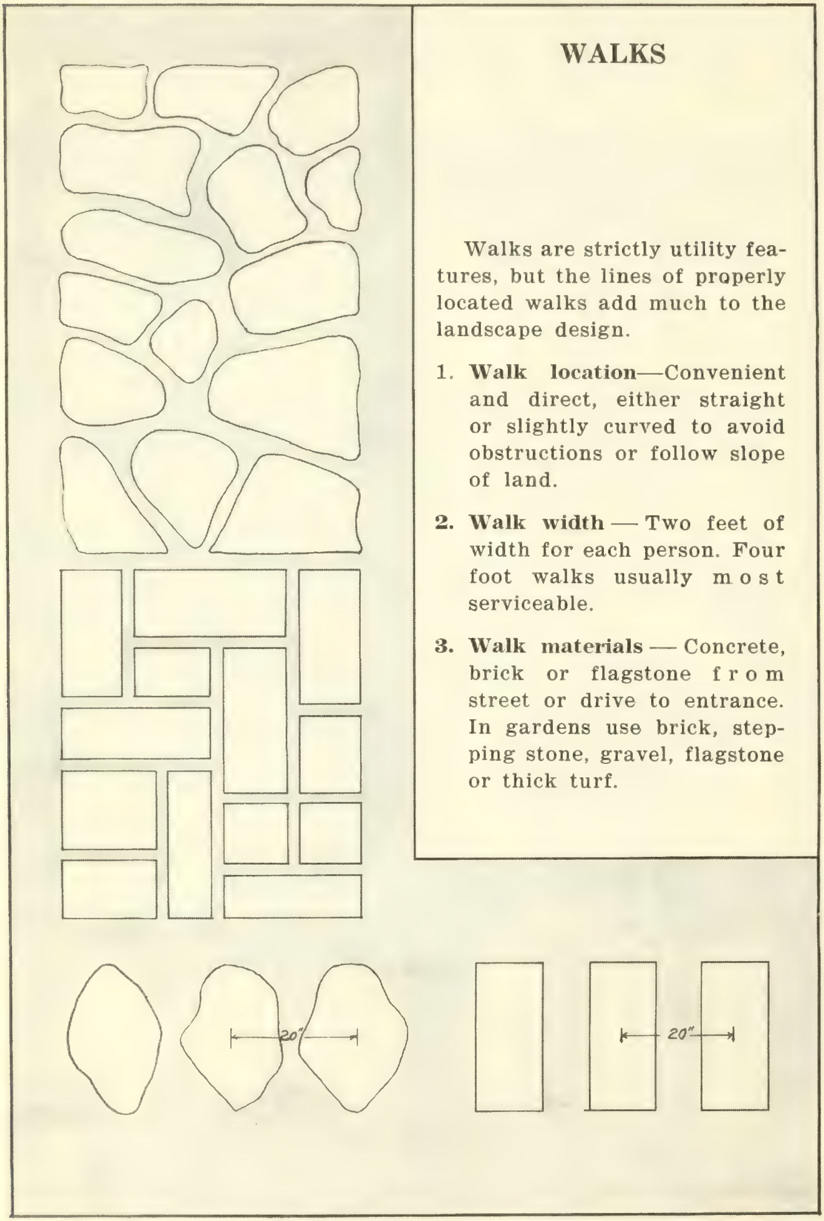


Figure 26

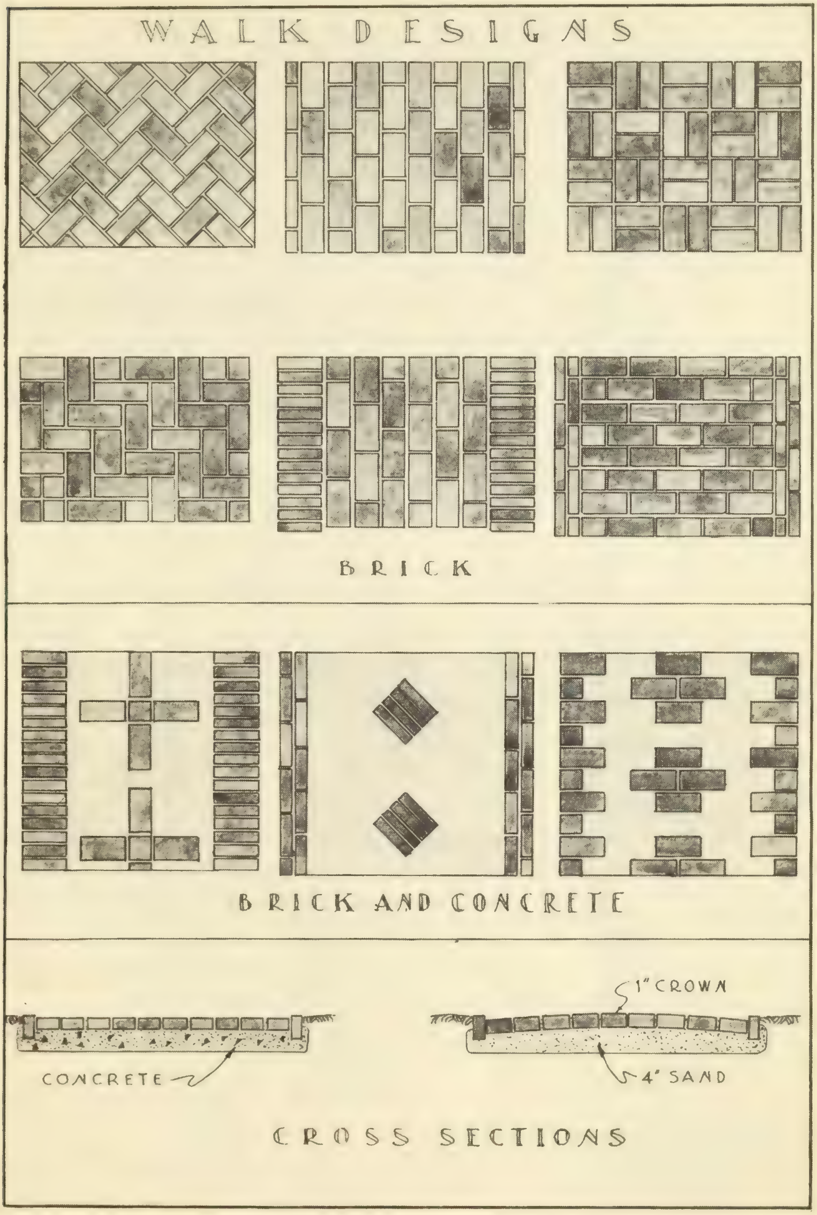

WALK DESIGNS
BRICK
BRICK AND CONCRETE
1" CROWN
CONCRETE
4" SAND
CROSS SECTIONS

Figure 27

RETAINING WALLS

Where the land slopes distinctly on the home grounds it is advantageous to grade so that areas are brought to different elevations which are nearly level. Where this is done terracing or the construction of retaining walls is necessary. Although terracing is less expensive, retaining walls conserve space, provide less danger of erosion, and add interest and variety.

Free standing walls are not to be confused with retaining walls. A free standing wall is usually faced on both sides and there is no lateral pressure which would tend to overturn it. On the other hand a retaining wall should be constructed so that it will have adequate stability to resist the lateral pressure from the supported bank of earth. This pressure can be withstood by giving the wall the necessary batter (slope toward bank) or by building of such material as brick or concrete to give stability. (See drawings on opposite page).

The foundation is one of the most important factors in the construction of any wall. That the foundation of all concrete or masonry walls rest on a well drained and solid natural subsoil is doubly important, since damage will be caused if the wall settles. Similar settlement of foundation under dry stone walls is not as serious as under concrete or masonry, since it can be more easily repaired. No wall should be placed on subsoil which is not thoroughly compacted. It is desirable to provide drainage by using cinders and agricultural tile as shown on opposite page, especially in heavy clay soils where drainage is inadequate.

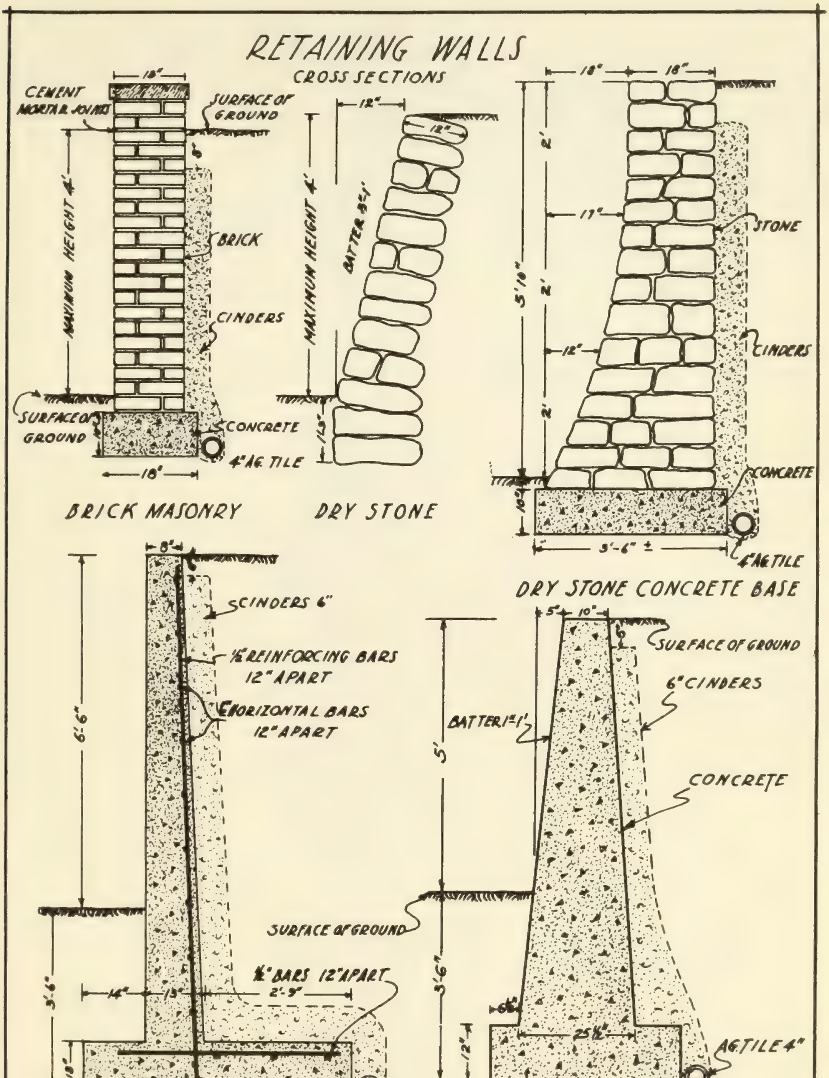

RETAINING WALLS
CROSS SECTIONS
18"
CEMENT MORTAR JOINTS
SURFACE OF GROUND
8"
MAXIMUM HEIGHT 4'
BRICK
CINDERS
SURFACE OF GROUND
CONCRETE
4" AG. TILE
18"
BRICK MASONRY
12"
12"
MAXIMUM HEIGHT 4'
BATTER 3"=1'
12"
DRY STONE
18"
18"
5'10"
2'
17"
2'
12"
2'
STONE
CINDERS
CONCRETE
10"
3'-6" ±
4" AG. TILE
DRY STONE CONCRETE BASE
8"
6'6"
CINDERS 6"
½" REINFORCING BARS 12" APART
HORIZONTAL BARS 12" APART
SURFACE OF GROUND
3'6"
½" BARS 12" APART
14"
13"
2'-9"
18"
½" BARS 12" APART
⅜" BARS 12" APART
4" AG. TILE
9"
12"
REINFORCED CONCRETE WALL
5"
10"
6
SURFACE OF GROUND
6" CINDERS
BATTER 1"=1'
5'
CONCRETE
3'6"
6"
25½"
12"
AG. TILE 4"
3'-6"
CONCRETE
MODIFIED FROM DRAWINGS OF RETAINING WALLS PREPARED IN OFFICE OF A.D. TAYLOR

Figure 28

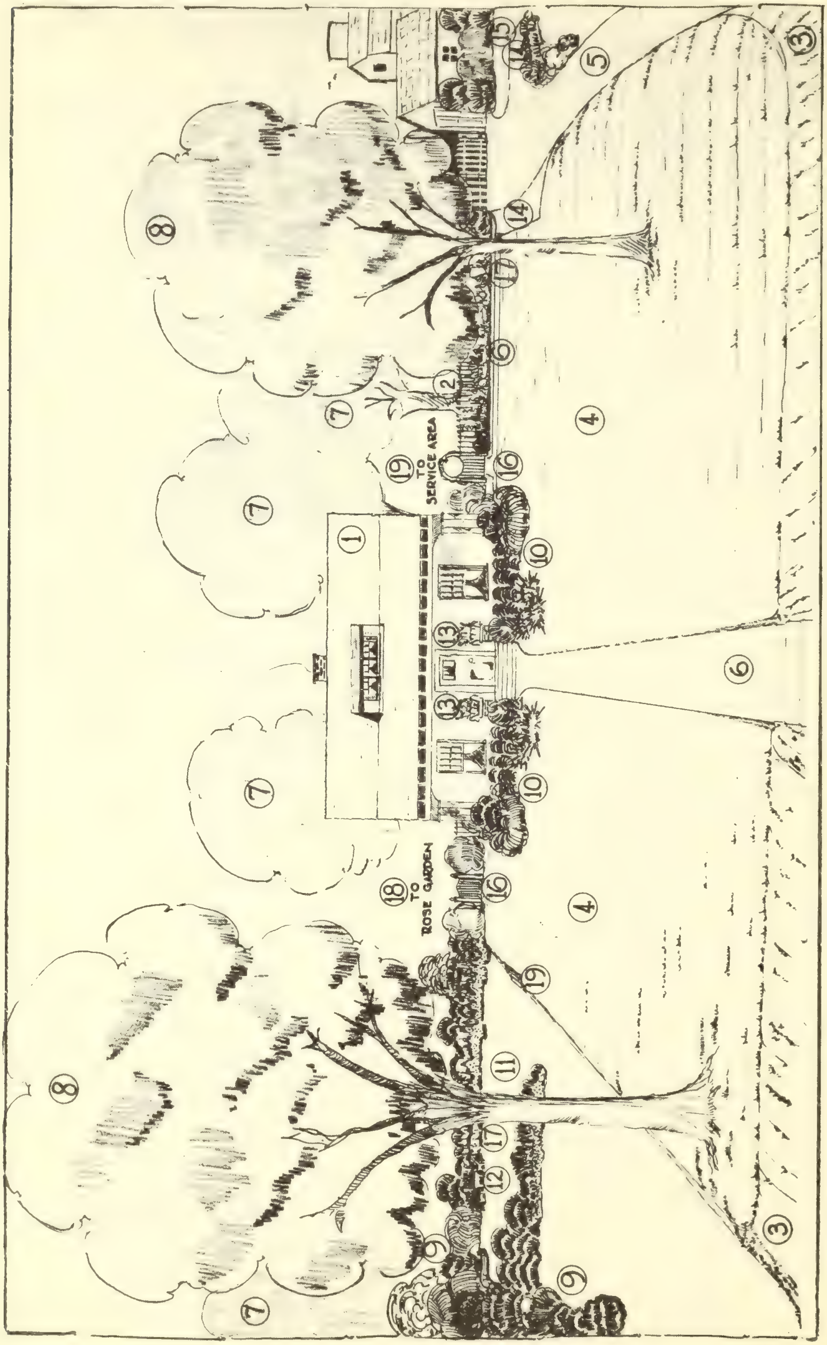

7
8
9
9
3
12
17
11
19
18
TO ROSE GARDEN
16
4
7
10
1
13
13
6
10
7
19
TO SERVICE AREA
16
4
7
2
6
17
8
14
15
14
5
3

Figure 29

THE COMPLETE LANDSCAPE PICTURE

Study the picture and note how each of the following points help make the complete landscape picture.

1. House painted and in good repair.
2. Fences, if necessary, enclosing as large an area as possible and in good repair. Gates should be on good hinges.
3. Proper grading and terracing provides good drainage and an attractive setting for the house.
4. An open, smooth, well established lawn is very necessary.
5. The driveways should be properly located as conveniently as possible and given an all-weather surface.
6. Walks should be direct and as numerous as necessary to keep the feet dry and free of mud. Place them so they will be used.
7. Trees are needed as a background.
8. Trees are needed for shade and to frame the house.
9. Border plantings of flowering and native shrubs enclose the yard, screen undesirable views, and form a background for the picture.
10. Foundation plantings blend the base of the house with the ground, softening hard lines, giving the house a setting.
11. Out-door living rooms make the yard usable. They should be easily accessible from the house and should be private.
12. Lawn furniture, outdoor fireplaces, pool, arbors, etc. are standard equipment for the outdoor living room. They make the grounds more useful.
13. Flower boxes add year round beauty.
14. Parking and turn-arounds add to the convenience of the grounds.
15. Screen plantings can be made to hide objectionable objects. The garage can best be screened when it is placed parallel with the road and to the rear of the house.
16. Gates and trellises add variety and interest to the picture.
17. Flower beds are planted along the borders and fences, leaving the lawn open and unbroken.
18. Rose gardens are more successful when planted in formal beds in a separate garden.
19. The service area should be apart from the rest of the yard, behind a hedge or fence. The clothes line, wood pile, etc. are located here.

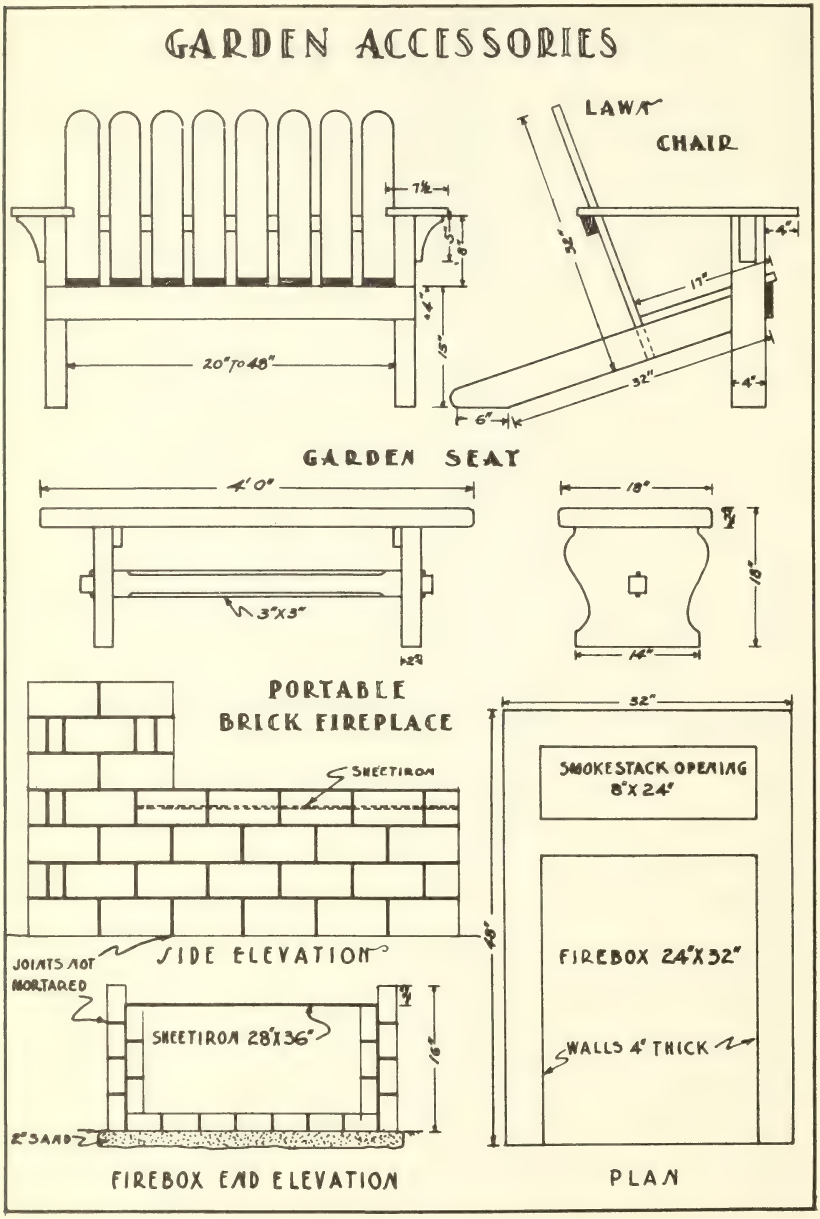

GARDEN ACCESSORIES
LAWN CHAIR
7½
5"
8"
4"
15"
20" TO 48"
32"
17"
4"
32"
4"
6"
GARDEN SEAT
4'0"
3"X3"
18"
¾
18"
14"
PORTABLE BRICK FIREPLACE
SHEETIRON
SIDE ELEVATION
JOINTS NOT MORTARED
SHEETIRON 28"X36"
¾
16"
2" SAND
FIREBOX END ELEVATION
32"
SMOKESTACK OPENING 8"X24"
48"
FIREBOX 24"X32"
WALLS 4" THICK
PLAN

Figure 30

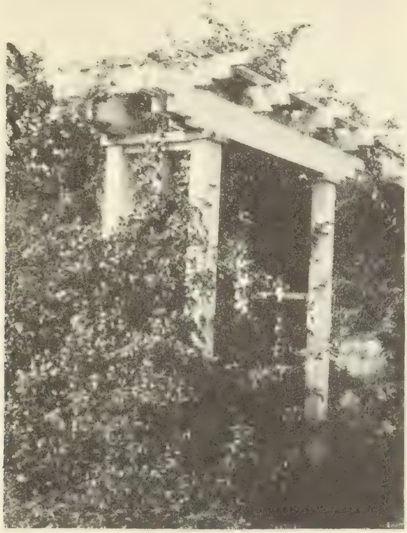


Figure 31

Garden arch showing details of construction. This type of arch would make an appropriate entrance to garden.

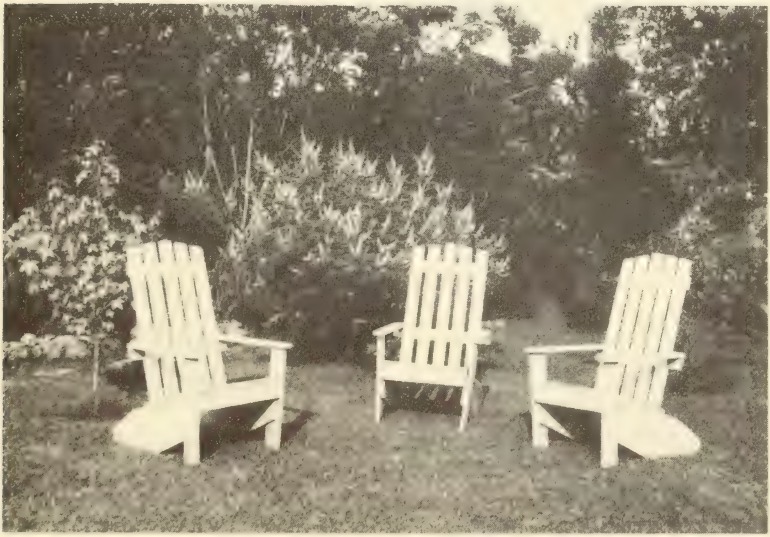
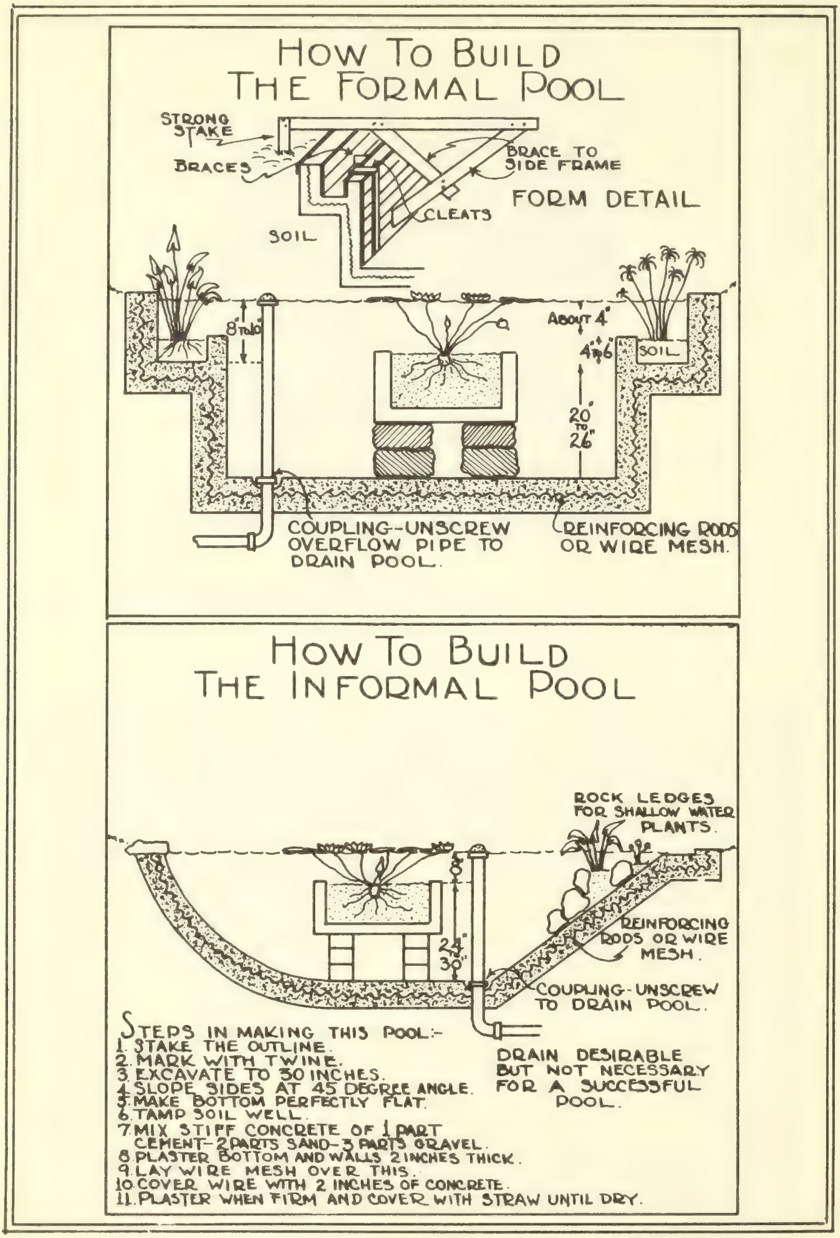


Figure 32

Finish the picture by furnishing the lawn.



HOW TO BUILD THE FORMAL POOL

STRONG STAKE
BRACES
BRACE TO SIDE FRAME
FORM DETAIL
CLEATS
SOIL
8" TO 10"
ABOUT 4"
4" TO 6"
SOIL
20" TO 26"
COUPLING--UNSCREW OVERFLOW PIPE TO DRAIN POOL.
REINFORCING RODS OR WIRE MESH.

HOW TO BUILD THE INFORMAL POOL

ROCK LEDGES FOR SHALLOW WATER PLANTS.
8"
24" 30"
REINFORCING RODS OR WIRE MESH.
COUPLING-UNSCREW TO DRAIN POOL.
DRAIN DESIRABLE BUT NOT NECESSARY FOR A SUCCESSFUL POOL.

STEPS IN MAKING THIS POOL:-

1. STAKE THE OUTLINE.
2. MARK WITH TWINE.
3. EXCAVATE TO 30 INCHES.
4. SLOPE SIDES AT 45 DEGREE ANGLE.
5. MAKE BOTTOM PERFECTLY FLAT.
6. TAMP SOIL WELL.
7. MIX STIFF CONCRETE OF 1 PART CEMENT-2 PARTS SAND-3 PARTS GRAVEL.
8. PLASTER BOTTOM AND WALLS 2 INCHES THICK.
9. LAY WIRE MESH OVER THIS.
10. COVER WIRE WITH 2 INCHES OF CONCRETE.
11. PLASTER WHEN FIRM AND COVER WITH STRAW UNTIL DRY.

Figure 33

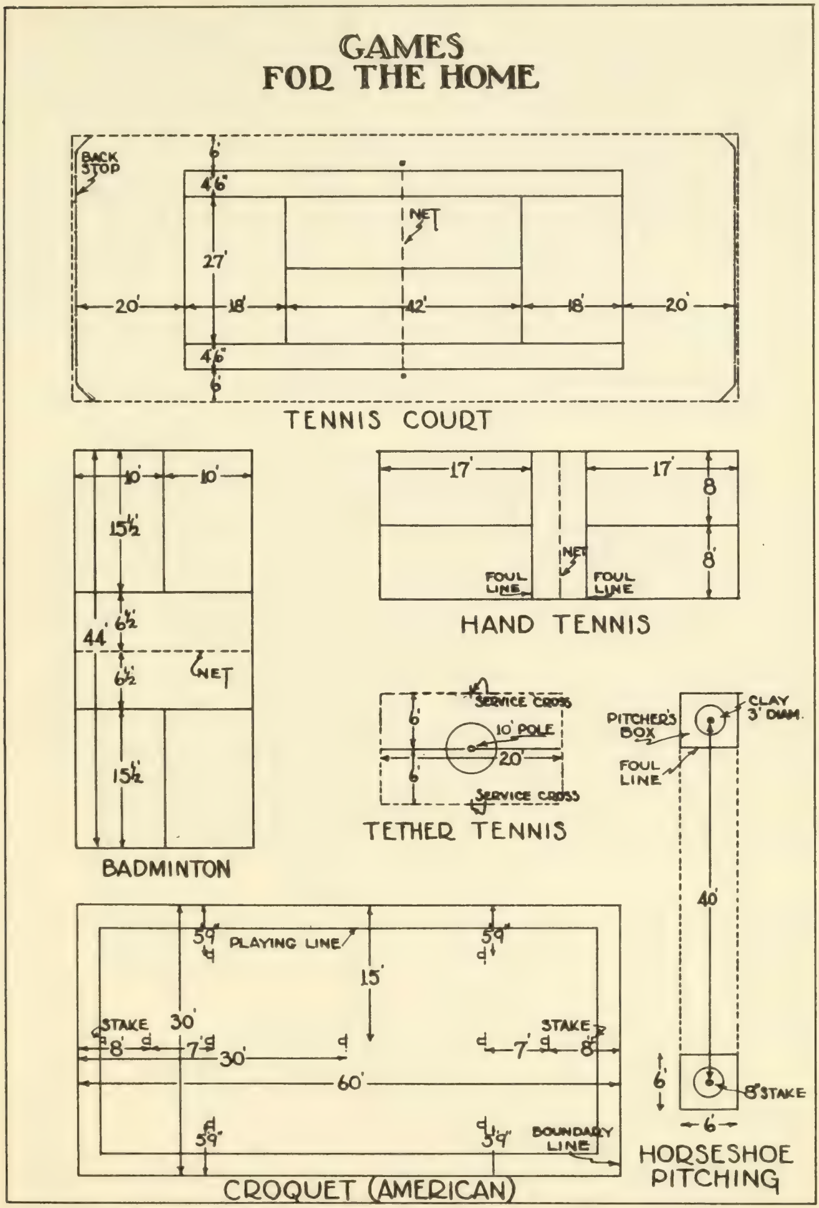

GAMES
FOR THE HOME
BACK STOP
6'
4'6"
NET
27'
20'
18'
42'
18'
20'
4'6"
6'
TENNIS COURT
10'
10'
15½'
6½'
44'
6½'
NET
15½'
BADMINTON
17'
17'
8'
8'
NET
FOUL LINE
FOUL LINE
HAND TENNIS
SERVICE CROSS
6'
10' POLE
20'
6'
SERVICE CROSS
TETHER TENNIS
PITCHER'S BOX
CLAY 3' DIAM.
FOUL LINE
40'
6'
8" STAKE
6'
HORSESHOE PITCHING
5'9"
PLAYING LINE
15'
5'9"
STAKE
30'
8'
7'
30'
STAKE
7'
8'
60'
5'9"
5'9"
BOUNDARY LINE
CROQUET (AMERICAN)

Figure 34

MISSISSIPPI LAWNS

The lawn is the most important part of the landscape picture. It furnishes the setting for the house and garden, prevents erosion, eliminates dust and mud, and adds to the cool comfort of the home and grounds. In spite of such practical usefulness, the lawn is frequently poor, thin and weedy or may be entirely lacking.

The heat of southern summers combined with relatively dry periods during July and August limits the variety of grasses that can be used for lawns in the South. The success of a southern lawn depends upon the selection of the proper grass suited to the particular section of the South and to the local conditions of sun, shade and moisture. The right grass can only succeed when suitable soil preparation is made, plant food supplied, and when correctly planted, watered and clipped.

The following grasses may be used successfully in the South for conditions and locations indicated:

Northern Mississippi

1. Bermuda—Sun or slight shade. Plants or seed. Two to 3 pounds of good quality seed per 1,000 square feet.
2. Kentucky Bluegrass—Shade only. Seed. Use 3 to 4 pounds of seed per 1,000 square feet.
3. Lespedeza (Japanese Clover)—Sun, thin soils. With other grasses. Seed. One-half pound of seed per 1,000 square feet.
4. Italian Rye Grass—Sun or slight shade. Winter lawn. Seed. Three pounds of seed per 1,000 square feet.

Central Mississippi

1. Bermuda—Sun or slight shade. Plants or seed. Two to 3 pounds of good quality seed per 1,000 square feet.
2. Carpet Grass—Sun or slight shade. Seed or plants. Two to 3 pounds of seed per 1,000 square feet.
3. Lespedeza (Japanese Clover)—Sun, thin soils. With other grasses. Seed. One-half pound of seed per 1,000 square feet.
4. Italian Rye Grass—Sun or slight shade. Winter lawn. Seed. Three pounds of seed per 1,000 square feet.

Southern Mississippi

1. Bermuda—Sun or slight shade. Plants or seed. Two to 3 pounds of good quality seed per 1,000 square feet.
2. Carpet Grass—Sun or slight shade. Seed or plants. Two to 3 pounds of seed per 1,000 square feet.
3. St. Augustine Grass—Sun or shade. Cuttings.
4. Centipede Grass—Sun, dry sandy soils. Cuttings.
5. Lespedeza (Japanese Clover)—Sun, thin soils. With other grasses. Seed. One-half pound of seed per 1,000 square feet.
6. Italian Rye Grass—Sun or slight shade. Winter lawns. Seed. Three pounds of seed per 1,000 square feet.

The plowing and fertilization recommended in establishing new lawns and renovating old lawns in the South can be done any time during spring or summer when there is sufficient moisture in the soil for plowing. The sooner it is done after the first of March the greater will be the growth of grass the first season.

Best results are usually had by sowing the lawn grass seed after a good rain or soon after plowing and discing where there is considerable moisture in the soil. A windy day should be avoided for seed sowing, as an even scattering of the seed cannot be secured. A roller should be used immediately after sowing of the seed to insure good contact between the soil and the seed. This is very necessary if seed of Bermuda grass is being used. Avoid cheap seed.

When Bermuda sod is used, open furrows 4 inches deep and 12 to 18 inches apart. Drop pieces of sod about the size of one's fist 12 to 18 inches apart in the furrows and cover. The surface should be made perfectly smooth. Sodding may be done any time of the year when sufficient moisture is present. This recommendation also applies to planting carpet, St. Augustine and Centipede grasses.

A SUGGESTED CULTURAL AND FERTILIZER SCHEDULE FOR MISSISSIPPI LAWNS

A. New lawns and renovating old lawns:

1. Apply 1,000 pounds well rotted manure or compost to each 1,000 square feet.
2. Plow as for a garden in February, March, April or May.
3. Add 25 pounds of 6-8-6 fertilizer to each 1,000 square feet.
4. Disc, harrow, drag and seed or sod immediately. Seeded or sodded ground should be rolled with a 500-pound roller.

B. Maintaining well established lawns:

1. Mow regularly, once a week, during periods of rapid growth. Set mower to cut grass 2 to 3 inches in height.
2. Water thoroughly, if possible, every 2 weeks during dry periods.
3. Apply a mixture of one-fourth sulphate of ammonia or nitrate of soda and three-fourths cottonseed meal as a top dressing. This material should be applied at the rate of 10 pounds per 1,000 square feet. Better results will be secured if 4 pounds of muriate of potash is added to every 10 pounds of the cottonseed meal and nitrogen mixture. Apply this at the rate of 14 pounds per 1,000 square feet. Make first application in early spring and apply succeeding application every 2 months. For instance, if the first application is made March 1, other treatment should be made May 1, July 1, and September 1. Do not apply this top dressing after October 1.
4. Italian rye grass can be planted in well established sod for a green winter lawn. Sow seed at the rate of 3 pounds per 1,000 square feet in October, November or December. Rake in with the back of a rake.

Watering during the summer is particularly beneficial to new lawns. Fertilizers can be used by the plant only when there is moisture present to put it into solution; however, soil well supplied with nitrogen, phosphorous and potash will support grass during dry periods more satisfactorily than poor soils. When watering, soak the lawn to a depth of 6 inches every 2 weeks. Do not sprinkle lightly every few days because this brings the roots to the surface. Shallow roots die quickly in dry periods.

PLANTING LIST FOR LANDSCAPING MISSISSIPPI HOMES

TABLE I—TREES (Deciduous)

Key No.	Common Name	Botanical Name	Size	Advantages	Disadvantages
1	Apricot	Prunus armeniaca	Small	Rapid growth; beautiful spring flowers; wide spreading top that makes good shade	Spring freezes often kill fruit making it unreliable as a fruit tree
2	Crabapple, Flowering	Malus species	Small	Affords great variety of flower color —red, pink, white; attractive fruit; useful in the border planting	Subject to San Jose scale and cedar apple rust; like other apples not well adapted to South Mississippi
3	Cypress, Bald	Taxodium, distichum	Large	Attractive feathery foliage; symmetrical form; good lawn tree; adapted to wet or dry soil conditions	Difficult to transplant
4	Dogwood, Flowering	Cornus florida	Small	Native plant adapted to Mississippi conditions; produces abundance of white flowers in spring and red fruits in fall; fine for border planting	Must be transplanted from woods when small—3′ to 4′ in height
5	Elm, American	Ulmus americana	Large	Form of tree well suited to landscape uses	Trees very susceptible to borers, elm leaf scale, red spider, leaf hoppers, mildew, virus diseases; needs much care when transplanted; this tree often weakened by root girdling
6	Ginkgo, (Maidenhair Tree)	Ginkgo biloba	Medium	Unusual form and foliage; something different; long-lived; suitable for specimen, street or roadside planting	Slow growth; good nursery grown trees not generally available
7	Gum, Sweet	Liquidambar, styraciflua	Large	Rugged, interesting tree in form and fruit; glossy, attractive foliage; good fall color; adapted to both bottoms and upland	Slow growing when young; seed burs undesirable on lawn, making it unsuited for lawn planting

TABLE I—continued

Key No.	Common Name	Botanical Name	Size	Advantages	Disadvantages
8	Hackberry	Celtis occidentalis and Celtis mississippiensis	Medium	Rapid grower, making a spreading, dignified tree of dense foliage; sturdy tree; well adapted to shade tree uses	Leaves very susceptible to insect injury, but this seldom reaches serious proportions
9	Mimosa	Albizzia julibrissin	Small	Beautiful form, foliage, and pink summer flowers; best small summer flowering tree for specimen, or border planting	Due to low head (short trunk) has limited use
10	Maple, Red	Acer rubrum	Medium	Attractive red flowers in spring and good fall color	Slow growing; needs abundant moisture
11	Oak Pin	Quercus palustris	Large	Upright, symmetrical tree having rich lustrous foliage; strong structural quality in heavy hard wood makes it a long-lived tree	Slow growing; difficult to transplant
12	Oak, Southern Red	Quercus rubra	Large	Spreading, rugged tree of large proportions; rich, lustrous foliage—beautiful in fall color; strong structural quality in heavy hardwood; long-lived tree	Slow growing; difficult to transplant
13	Oak, Water and Willow	Quercus nigra and Quercus phellos	Large	Mississippi's best general purpose shade trees; rich, lustrous foliage; strong structural quality in heavy hardwood; long-lived tree	Slow growing; difficult to transplant larger sizes of trees
14	Peach, Flowering	Prunus persica	Small	Attractive, double flowers that last several weeks; rapid grower; easily transplanted	Subject to injury from San Jose scale and peach tree borer; relatively short lived

TABLE I—continued

Key No.	Common Name	Botanical Name	Size	Advantages	Disadvantages
15	Pecan	Carya pecan	Large	Long-lived; relatively rapid grower; valuable for shade, beauty and nuts.	Insect pests numerous; these bugs frequently drop from tree to outdoor living room users; rapidly depletes soil of food elements; rather dirty tree, keeping lawn full of litter
16	Poplar, White	Populus alba	Medium	Produces quick shade; silvery foliage gives good contrast with green leaves of other trees	Short lived tree; borers and disease a menace; branches easily broken; suckers freely
17	Red Bud	Cercis canadensis	Small	A most attractive tree, abundant in Mississippi woods; masses of purplish red flowers produced every spring	Somewhat difficult to transplant; needs water when becoming established; subject to leaf injury by leaf rollers
18	Soapberry	Sapindus drummondi	Small	Adapted to dry soils; graceful growth and fine textured leaves; attractive golden fruit	Not well known; not generally available; the tree in its native habitat is weedy and apparently undesirable; it is greatly improved by cultivation
19	Sycamore	Platanus occidentalis	Large	Stately size; fruit and white bark produces beautiful winter effect; adds dignity to the home; rapid growth	Produces untidy lawn conditions; wood brittle; relatively short lived; subject to leaf feeding insects
20	Walnut	Juglans nigra	Medium	Attractive form and foliage; nuts useful; resistant to wind damage	Needs deep soil; leaf eating insects are abundant
21	Willow, Weeping	Salix babylonica	Small	Shapely form well adapted to pool plantings; relatively few insects; easily propagated and transplanted	Short lived; needs moisture; roots detrimental to sewer lines and poorly constructed pools

TREES—EVERGREEN

TABLE II

Key No.	Common Name	Botanical Name	Height in Feet	Remarks
22	Cedar, Red	Juniperus virginiana	30-40	Limited use as tree to screen plantings; adapted to clipped hedge uses
23	Fir, Chinese	Cunninghamia lanceolata	50-60	Good specimen upright evergreen for South Mississippi
24	Cedar, Deodar	Cedrus deodara	60-70	Good specimen for Mississippi but has serious insect trouble
25	Holly, American	Ilex opaca	30-40	Beautiful tree in foliage and fruit; needs acid soil; only female plants produce fruit; male plant needed for pollination.
26	Magnolia, Southern	Magnolia grandiflora	50-60	State flower; good background tree; litters lawn
27	Oak, Live	Quercus virginiana	60-70	South Mississippi's best shade tree
28	Pines	Pinus species	60-80	Many uses—framing, background, specimen

SHRUBS—BROADLEAF EVERGREENS

TABLE III

Key No.	Common Name	Botanical Name	Height in Feet	Flowering		Fruit	Range
				Time	Color		
29	Abelia	Abelia grandiflora	5-8	May-Oct.	Pinkish White	None	North and Central Mississippi
30	Ardisia	Ardisia crenulata	3-4	August	White	Red in Winter	South and Central Mississippi
31	Azalea	Azalea indica Azalea kurume	10-15 6-8	Mar. & April	Various Various	....	South and Central Mississippi
32	Azalea	Azalea hinodergiri Azalea macrantha	4-6 4-6	April April	Red Various	....	Entire state
33	Bamboo	Phyllostachys species	10-20	....	....	....	Entire state
34	Banana Shrub	Michelia fuscata	10-20	Mar.-May	Cream	....	South and Central Mississippi
35	Boxwood, Dwarf	Buxus sempervirens suffruticosa	3-6	....	....	....	Entire state
36	Boxwood, Tree	Buxus sempervirens	10-20	....	....	....	Entire state
37	Camellia, Winter Flowering	Camellia japonica	10-20	Jan.-Feb.	White to Red	....	South and Central Mississippi
38	Camellia, Fall Flowering	Camellia sasanqua	6-10	Oct.-Nov.	White, red and pink	....	Entire state
39	Cape Jasmine	Gardenia florida	5-8	May-June	White	....	All but extreme north part of Mississippi
40	Cherry Laurel	Laurocerasus caroliniana	20-30	Apr.-May	White	Black in Winter	Entire state

TABLE III—continued

Key No.	Common Name	Botanical Name	Height in Feet	Flowering		Fruit	Range
				Time	Color		
41	Cleyera	Cleyera japonica	6-10	May-June	Creamy White	Red in Winter	South and Central Mississippi
42	Eleagnus	Eleagnus pungens	10-20	Oct.-Nov.	Creamy White	Red in Spring	Entire state
43	Euonymus (Large Leaf Boxwood)	Euonymus japonica	12-20	....	....	Sometimes Orange in Winter	Entire state
44	Euonymus, Spreading	Euonymus patens sieboldi	7-10	....	....	Orange in Winter	Entire state
45	Feijoa	Feijoa sellowiana	10-15	Apr.-May	White with Red Center	....	South and Central Mississippi
46	Firethorn, Laland	Pyracantha coccinea lalandi	12-20	April	White	Orange in Winter	Entire state
47	Firethorn, Red Fruited	Pyracantha gibbsi yunnanensis	6-10	April	White	Red in Winter	Entire state
48	Holly, Chinese	Ilex cornuta	6-10	....	....	Red in Winter	Entire state
49	Holly, Dwarf Japanese	Ilex crenata	4-6	....	....	Red in Winter	Entire state
50	Holly, Yaupon	Ilex vomitoria	15-20	....	....	Red in Winter	Entire state
51	Jasmine, Ever-blooming	Jasminum humile	2-4	Summer	Yellow	....	Entire state
52	Jasmine, Primrose	Jasminum primulinum	3-5	April	Yellow	....	Entire state
53	Jasmine, Winter	Jasminum nudiflorum	3-4	Jan.-Feb.	Yellow	....	Entire state

TABLE III—continued

Key No.	Common Name	Botanical Name	Height in Feet	Flowering		Fruit	Range
				Time	Color		
54	Laurestinus	Viburnum tinus	6-10	Feb.-Mar.	Pinkish White	....	Entire state
55	Mahonia, (Holly Grape)	Mahonia bealei	3-4	Feb.-Mar.	Yellow	Blue in Winter	Entire state
56	Nandina	Nandina domestica	5-7	May	White	Red in Fall and Winter	Entire state
57	Oleander	Nerium oleander	10-15	May	White and Pink	....	South Mississippi
58	Olive, Sweet	Osmanthus fragrans	12-15	Mar.-Apr.	White	....	South and Central Mississippi
59	Photinia, Low	Photinia serrulata	10-15	March	White	....	Entire state
60	Photinia, Scarlet	Photinia glabra	10-15	April	White	....	Entire state
61	Pittosporum	Pittosporum tobira	8-10	April	White	....	South and Central Mississippi
62	Privet, Small Leaf	Ligustrum ionandrum	6-8	April	White	....	Entire state
63	Privet, Chinese	Ligustrum sinense	15-20	April	White	Purple in Fall	Entire state
64	Privet, Glossy	Ligustrum lucidum	6-15	April	White	Purple in Fall	Entire state
65	Privet, Japanese	Ligustrum japonicum	15-20	April	White	Purple in Fall	All except extreme north part of state
66	Rosemary	Rosmarinus officinalis	3-4	May	Bluish Lavender	....	Entire state
67	Yucca, (Spanish Dagger)	Yucca aloifolia	4-6	June	White		Entire state

SHRUBS—NARROWLEAF EVERGREENS

TABLE IV

Key No.	Common Name	Botanical Name	Height in Feet	Form	Remarks
68	Arborvitae, Baker's	Thuja orientalis bakeri	10-20	Cigar like	Formal, compact shape and bright green evergreen foliage; useful, but life of plant very uncertain
69	Arborvitae, Berckman's	Thuja orientalis aurea nana	6-8	Low cone	Dwarf compact shape and yellowish green evergreen foliage; useful, but life of plant very uncertain
70	Arborvitae, Bonita	Thuja orientalis bonita	6-8	Ball like	Dwarf compact shape and green evergreen foliage; useful, but life of plant very uncertain
71	Cedar, Cannart Red	Juniperus virginiana cannarti	15-20	Compact, upright	Best formal accent evergreen, having dense, dark green foliage
72	Cedar, Silver Red	Juniperus virginiana glauca	15-20	Loosely upright	Light blue-green foliage, gives good contrast with darker foliage of other plants
73	Juniper, Pfitzer	Juniperus chinensis pfitzeriana	6-8	Low spreading	Best low growing, narrowleaf evergreen, spreads over 10 feet
74	Juniper, Savin	Juniperus sabina	6-8	Vase like	Dwarf, semi-upright, narrowleaf evergreen similar in leaf texture to Pfitzer Juniper
75	Juniper, Virginal	Juniperus virginalis globosa	6-8	Vase like	Best dwarf, upright, narrowleaf evergreen; several stems, fine texture
76	Yew, Japanese	Podocarpus macrophylla (chinensis)	10-20	Stiffly upright	Dark green foliage loosely arranged on stiff upright stem

FLOWERING SHRUBS

TABLE V

Key No.	Common Name	Botanical Name	Height in Feet	Flowering		Remarks
				Time	Color	
77	Almond, Flowering	Prunus glandulosa	2-3	March	Pink	Old fashioned flower still popular
78	Althea	Hibiscus syriacus	10-15	May-Oct.	White, pink and purple	Single and double flowers available
79	Barberry, Purple Leaf	Berberis vulgaris atropurpurea	3-4	....	....	Reddish-purple leaves give richness to planting
80	Butterfly-Bush	Buddleia davidi	4-5	June-Sept.	Purple	Fine summer flowering shrub, prune to ground each winter
81	Chaste Tree	Vitex agnus-castus	10-15	June-Sept.	Blue	Rapid grower, prolific bloomer
82	Crape Myrtle	Lagerstroemia indica	15-20	June-Sept.	Various	Fine as large plant in background or pruned to small plant
83	Deutzia, Fuzzy	Deutzia scabra	8-10	May	White	Tall, rather coarse background plant
84	Deutzia, Lemoine	Deutzia lemoinei	4-6	May	White	Low bush; prolific bloomer shady places
85	Goldenbell, Greenstem	Forsythia viridissima	6-8	March	Yellow	Rampant grower, green foliage and stems
86	Goldenbell, Showy	Forsythia intermedia	6-8	March	Yellow	Variety spectabilis most showy of Goldenbells
87	Honeysuckle, Tatarian	Lonicera tatarica	6-8	April	Red or White	Attractive red fruit in June
88	Honeysuckle, Winter	Lonicera fragrantissima	6-8	Jan.-Feb.	Cream	Almost evergreen, flowers very fragrant
89	Hydrangea, House	Hydrangea opuloides	3-5	June	Blue and Pink	Fine for shady places; flowers may change color

TABLE V—continued

Key No.	Common Name	Botanical Name	Height in Feet	Flowering		Remarks
				Time	Color	
90	Magnolia, Japanese Saucer	Magnolia soulangeana	20-25	Feb.	Purple	Excellent specimen plant; no pruning needed
91	Mock Orange, (English Dogwood)	Philadelphus virginal	4-6	May	White	Double, fragrant flowers on attractive bush
92	Pearlbush	Exochorda grandiflora	10-12	April	White	Flowers resemble pearls; very attractive
93	Pomegranate, Flowering	Punica granatum	10-15	June	White, red, variegated	Likely to winter kill in North Mississippi
94	Quince, Flowering	Cydonia japonica	6-8	Feb.-Mar.	White, pink, orange, red	One of most showy early flowering shrubs
95	Sage, Autumn	Salvia greggi	3-4	All summer	Carmine	Very hardy dwarf shrub, excellent for massing
96	Snowball, Japanese	Viburnum tomentosum	8-10	April	White	Variety plicatum fine; upright, bushy shrub
97	Spirea, Anthony Waterer	Spiraea bumalda Anthony waterer	2-4	May-Sept.	Rose	Free flowering if old flower heads are removed
98	Spirea, Bridal Wreath	Spiraea prunifolia	4-6	March	White	Small double rosette, flowers beautiful, plant has poor form
99	Spirea, Reeves	Spiraea reevesiana	5-7	April	White	Single or double flowers in large clusters similar to Vanhouttei
100	Spirea, Thunberg	Spiraea thunbergi	2-4	March	White	Beautiful dwarf plant; miniature willow-like foliage
101	Spirea, Vanhout	Spiraea vanhouttei	5-7	April	White	Most popular spirea
102	Weigela	Weigela rosea	6-8	April	Pink	Coarse, spreading shrub; hardy; prolific bloomer

VINES

TABLE VI

Key No.	Common Name	Botanical Name	Range	Exposure Sun or Shade	Use	Remarks
103	Clematis, Autumn	Clematis paniculata	Entire state	Sunny	Trellis	White feathery flowers and fruit in fall
104	Clematis, Jackman	Clematis jackmani	Entire state	Sunny	Trellis	Large, intense violet blooms
105	Fig Vine	Ficus pumila	South Mississippi	Sun or Shade	To cover rocks, walls, rustic work	Evergreen; dense, dark green foliage
106	Honeysuckle-Woodbine	Lonicera sempervirens	Entire state	Sun or shade	Trellis	Bright red flowers; yellow throat variety Heckrotti good
107	Ivy, Boston	Ampelopsis tricuspidata	North and Central Miss.	Sun or Shade	To cover masonry walls	Deciduous; blue fruit; fall color
108	Ivy, English	Hedera helix	Entire state	Shade	To cover rocks, walls and chimneys	Also good as ground cover under trees
109	Jasmine, Yellow	Gelsemium sempervirens	South and Central Miss.	Sun or Part shade	Trellis	Native vine; bright yellow; fragrant flowers
110	Jasmine, Star	Trachelospermum jasminoides	South and Central Miss.	Sun	Trellis	Best evergreen climber for South Mississippi
111	*Kudzu	Pueraria thunbergiana	Entire state	Sun	Ground cover; trellis for quick shade	Very rapid grower
112	Rose of Montana	Antigonom leptopus	Entire state	Sun	Trellis	Top winter kills; pink flowers June to October
113	Scarlet Berry	Cocculus carolinus	Entire state	Sun	Trellis	Native Carolina moonseed; beautiful red berries in fall

TABLE VI—continued

Key No.	Common Name	Botanical Name	Range	Exposure Sun or Shade	Use	Remarks
114	*Trumpet Creeper	Bignonia radicans	Entire state	Sun	Trellis	Native; the species grandiflora is better
115	Vinca, (Big Leaf)	Vinca major	Entire state	Shade	Ground cover; bank plantings	Large, evergreen, shiny leaves; blue flowers
116	Vinca (Myrtle)	Vinca minor	Entire state	Shade	Ground cover; bank plantings	Small, evergreen, shiny leaves; blue flowers
117	Virginia Creeper	Ampelopsis quinquefolia	Entire state	Sun or Shade	To cover walls or trellis for shade	Rapid grower; good fall color
118	Wistaria	Wistaria sinensis	Entire state	Sun or Partial Shade	Pergola or arbor	One of the most popular deciduous flowering vines

*Likely to beccme pests.

COMMON NATIVE SHRUBS OF MISSISSIPPI FOR LANDSCAPE PLANTING

TABLE VII

Key No.	Common Name	Scientific Name	Type	Height (Feet)	Light Preference	Color of Flowers	Season of Bloom	Areas in Mississippi where plants likely to be found growing native
119	Alder, Smooth	Alnus rugosa	Deciduous	6-25	Sun or partial shade	Green	April	Throughout State
120	Buckeye, Red	Aesculus pavia	Deciduous	4-12	Sun or partial shade	Purplish red	April	North and Central Mississippi in hill counties
121	Buckwheat Tree; Titi	Cliftonia monophylla	Broadleaf Evergreen	6-30	Sun or shade	Pinkish White	March	Extreme southern portion
122	Button Bush; Button Willow	Cephalanthus occidentalis	Deciduous	3-12	Sun or shade	White	July August	Central, northern and western parts of State
123	Chokeberry, Red	Aronia arbutifolia	Deciduous	6-10	Sun or partial shade	White	April	Throughout hill section of State
124	Dogwood, Roughleaf	Cornus asperifolia	Deciduous	8-15	Sun or partial shade	White	May June	Limestone region of Northeast and Central Mississippi
125	Dogwood, Silky Kinnikinnik	Cornus amomum	Deciduous	3-10	Sun or shade	White	May	Northern, central and Delta regions of State
126	Elder, American	Sambucus canadensis	Deciduous	6-12	Sun or shade	White	April May	Throughout the State
127	Fetter Bush	Leucothoe racemosa	Deciduous	5-10	Sun or shade	White	April	Southern pine region near coast
128	Fringe Tree; Grandsire Graybeard	Chionanthus virginica	Deciduous	12-30	Sun or partial shade	White	April	Central and South Mississippi
129	Gallberry; Inkberry; Winterberry	Ilex glabra	Broadleaf Evergreen	6-8	Sun or shade	White	April	Longleaf pine section of South Mississippi

TABLE VII—Continued

Key No,	Common Name	Scientific Name	Type	Height (Feet)	Light Preference	Color of Flowers	Season of Bloom	Areas in Mississippi where plants likely to be found growing native
130	Holly, Deciduous	Ilex decidua	Deciduous	20-30	Sun or shade			North, central and Delta section of State
131	Hydrangea, Oakleaf	Hydrangea quercifolia	Deciduous	4-6	shade	White	May June	Northern part of State
132	Indigo, False	Amorpha fruticosa	Deciduous	5-20	Sun or shade	Dark Violet	April	Throughout the State
133	Jersey Tea; Red Root	Ceanothus americana	Deciduous	1½-3	Sun or shade	White	May June	All sections of State except Delta region
134	Laurel, Mountain	Kalmia latifolia	Broadleaf Evergreen	4-10	Shade	Light Pink	April	Eastern part of State from Tennessee to coast
135	Leatherwood	Cyrilla racemiflora	Deciduous	10-30	Partial shade or shade	White	June	South Mississippi from coast about 100 miles northward
136	Mulberry, French	Callicarpa americana	Deciduous	3-6	Sun or partial shade	White	April	Throughout hill section of State
137	Myrtle, Wax; Candle Berry	Myrica cerifera	Broadleaf Evergreen	8-25	Sun or shade			Central and South Mississippi
138	Palmetto	Serenoa serrulata	Broadleaf Evergreen	2-4	Sun or shade	White	June	Central and South Mississippi
139	Pinxter Flower; Honeysuckle	Azalea nudiflorum	Deciduous	4-8	shade	Pink	March April	Throughout State
140	Snowball, American	Styrax americana	Deciduous	8-12	Sun or shade	White	April May	South Mississippi
141	Stewartia	Stewartia malachodendron	Deciduous	6-12	Sun	White	May	Southern counties
142	St. John's Wort	Hypericum densiflorum	Deciduous	5-6	Sun	Yellow	May July	South Mississippi

TABLE VII—Continued

Key No.	Common Name	Scientific Name	Type	Height (Feet)	Light Preference	Color of Flowers	Season of Bloom	Areas in Mississippi where plants likely to be found growing native
143	Stink Bush; Anise Tree; Flintleaf	Illicium floridanum	Broadleaf Evergreen	6-8	Shade	Dark Red	March April	South Mississippi
144	Strawberry Bush	Euonymus americana	Deciduous	6-8	Shade	Yellowish or red-gr.	April	Hill counties from Tennessee to Jones County
145	Sumac, Dwarf; Sumac, Shining	Rhus copallina	Deciduous	Usually 4-12	Sun or shade	Greenish	June	Throughout State
146	Sumac, Smooth	Rhus glabra	Deciduous	6-15	Sun	Greenish	June	Throughout State
147	Sumac, Staghorn	Rhus typhina	Deciduous	10-25	Sun or shade	Greenish	June	Throughout State
148	Sweet Shrub	Calycanthus florida	Deciduous	3-6	Sun or shade	Dark red	April May	Eastern part of State from Tennessee south
149	Witch-Hazel	Hamamelis virginiana	Deciduous	15-25	Sun or shade	Yellow	Oct. Nov.	Throughout hill section
150	Yaupon	Ilex vomitoria	Broadleaf Evergreen	10-25	Sun or shade			South Mississippi

PERENNIALS

TABLE VIII

Common name	Botanical name	Height	Flowering		Exposure Sun or Shade	Planting Distance	Remarks
			Time	Color			
Alyssum, Goldentuft	Alyssum saxatile	8″-12″	Mar.-Apr.	Yellow	Sun	12″-18″	Good for rock garden and low borders
Anchusa, Bugloss	Anchusa myosotidiflora	12″-15″	April-May	Blue	Any	12″-18″	
Autumn Glow	Rudbeckia laciniata	5′-7′	Aug.-Oct.	Yellow	Sun	18″-24″	Rather coarse; best suited for tall border planting
Babysbreath	Gypsophila paniculata	18″-24″	May-June	White	Sun	18″-24″	Very good cutflower; may be dried
Baloonflower	Platycodon grandiflora	12″-18″	May-June	White blue	Sun	8″-12″	Plant on well drained soil. Disturb as little as possible
Bee Balm	Monarda didyma	2′-3′	May-June	Various	Any	12″	Divide every second year; weedy
Blanket Flower	Gaillardia pulchella	12″-18″	May-July	Yellow orange red	Sun	8″-10″	Very desirable for brilliant colors
Butterfly Weed	Asclepias tuberosa	18″-30″	May-July	Orange	Sun	12″-15″	Native, rather difficult to transplant from woods
Candytuft	Iberis sempervirens	6″-8″	April	White	Shade	10″-15″	
Cardinal-Flower	Lobelia cardinalis	3′-4′	July-Aug.	Red	Any	8″-12″	Native
Chrysanthemum, Common Hardy	Chrysanthemum species	2′-3′	Summer and Fall	Various	Sun	8″-12″	Very good for fall color
Columbine	Aquilegia coerulea	18″-24″	Apr.-May	Blue	Shade	12″-18″	Do not transplant frequently. Other species desirable

TABLE VIII—Continued

Common name	Botanical name	Height	Flowering		Exposure Sun or Shade	Planting Distance	Remarks
			Time	Color			
Coneflower, Purple	Rudbeckia purpurea	2′-3′	May-June	Purple	Sun	8″-10″	Native in Northeast Mississippi
Coreopsis	Coreopsis grandiflora	2′-4′	May-June	Yellow	Any	12″-18″	Reseeds readily
Daisy, Oxeye	Chrysanthemum leucanthemum	2′-3′	Apr.-May	White and Yellow	Sun	12″-18″	Reseeds readily; good for poor soil
Daisy, Painted	Pyrethrum roseum	18″-24″	April	Various	Sun	12″-15″	
Daisy, Shasta	Chrysanthemum maximum	18″-24″	Apr.-June	White and Yellow	Sun	12″-18″	Good cutflowers
False Dragonhead	Physostegia virginica	2′-3′	June-July	White to Purple	Sun	12″-15″	Transplant every second year; reseeds readily
Feverfew	Matricaria capensis	2′-3′	May	White	Sun	12″-18″	Likely to winterkill if not protected
Fountain Grass	Pennisetum japonicum	5′-6′	July-Sept.	White	Sun	3′-4′	
Gayfeather	Liatris pycnostachya	3′-5′	July-Aug	Purple	Sun	8″-12″	Desirable cutflower, fine keeping qualities
Goldmoss	Sedum acre	4″-6″	April	Yellow	Any	6″-8″	Fine for rock gardens and banks
Leadwort	Plumbago larpentae	6″-8″	July-Aug.	Blue	Any	6″-8″	Good for hot, dry locations
Michaelmus Daisy	Aster species	2′-3′	October	Various	Sun	12″-18″	Very good for the autumn garden; divide frequently
Milfoil or Yarrow	Achillea millefolium	2′-3′	Apr.-May	White Pink	Any	10″-12″	Good for very dry situations

TABLE VIII—Continued

Common name	Botanical name	Height	Flowering		Exposure Sun or Shade	Planting Distance	Remarks
			Time	Color			
Nepeta	Nepeta mussini	4″-6″	Mar.-May	Lavender	Sun	8″	Very compact; good edging; rock garden
Pampas Grass	Cortaderia argentia	8′-10′	Aug.-Sept.	Cream	Sun	4′-5′	
Pentstemon	Pentstemon barbatus	2′-3′	May-June	Red	Sun	10″-12″	Loose habit of growth
Peony	Paeonia officinalis	18″-24″	Apr.-May	Various	Sun	2′-3′	Best suited to North Mississippi
Phlox, Garden	Phlox paniculata	2′-3′	June	Various	Sun	12″-15″	Some varieties very susceptible to blight
Phlox, Moss Thrift	Phlox subulata	4″-6″	Mar.-Apr.	Various	Any	10″-12″	Profusion of bloom; very satisfactory
Pink, Grass	Dianthus plumarious	8″-12″	Apr.-May	Various	Sun	10″-12″	Very pleasing fragrance
Poppymallow, Low	Callirhoe involucrata	8″-12″	Apr.-June	Purple	Any	8″-12″	Makes attractive mass of foliage
Plumepoppy	Bocconia cordata	6′-8′	May-June	Cream	Sun	12″-18″	Suitable for background and screen
Red Hot Poker	Kniphofia uvaria pfitzeriana	2′-3′	July-Sept.	Red	Sun	10″-12″	
Sage, Azure	Salvia azurea	2′-3′	July-Aug.	Blue	Sun	10″-12″	Replant every third year
Sea-Lavender, Bigleaf	Statice latifolia	18″-24″	May-June	Purplish	Sun	12″-18″	Good for cutflowers; may be dried
Sea-Lavender	Statice dumosa	18″-24″	May-June	Cream	Sun	12″-15″	Reseeds readily
Soapwort, Rock	Saponaria ocymoides	6″-8″	Mar.-Apr.	Rose	Sun	6″-8″	Blooms profusely; good for rock gardens

TABLE VIII—Continued

Common name	Botanical name	Height	Flowering		Exposure Sun or Shade	Planting Distance	Remarks
			Time	Color			
Speedwell	Veronica longiflora	18″-24″	Apr.-May	Blue	Sun	12″	Good for cutflowers
Spiderwort	Tradescantia virginica	18″-24″	Apr.-May	Blue	Any	8″-10″	Good for shade
Stoke's Aster	Stokesia laevis	12″-18″	May-Sept.	Blue	Sun	12″-15″	Suitable for low, poorly drained places
Sweetpea, Perennial	Lathyrus latifolia	Vine	May-Oct.	Various	Sun	6″-8″	Used on trellis; cutflowers
Sweet William	Dianthus barbatus	12″-18″	Apr.-May	Various	Sun	8″-12″	Biennial
Transvaal Daisy	Gerbera jamesoni	18″-24″	Apr.-Oct.	Various	Sun	12″	Not recommended for inexperienced gardener
Valerian	Valeriana coccinea	18″-24″	Apr.-May	Rose	Any	12″	
Violet, Sweet	Viola odorata	4″-6″	March	Violet	Any	6″	
Wallflower	Cheiranthus allioni	6″-8″	Feb.-Apr.	Orange	Sun	12″	Cut off top after blooming

PLANTING CHART FOR BULBOUS PLANTS

TABLE IX

Common name	Scientific name	Height	Time of bloom	Color of bloom	Time to divide	Time to plant	Depth to plant	Distance Apart to plant	Location Sun, Shade	Use
Amaryllis	Hippeastrum vittatum	18-24″	April	Several	August	Aug.-Oct.	1 in.	8-12 in.	Sun	Borders Bedding
Brodiaea	Brodiaea uniflora	4-6″	March	Many	June	Jun.-Nov.	3 in.	2-3 in.	Any	Edging, Naturalizing
Canna	Canna sp.	3-5′	July-Sep.	Many	Dec.-Mar.	Dec.-Apr.	3-4 in.	8-15 in.	Sun	Bedding
Crocus, Autumn	Colchichum autumnale	3-6″	August	White Purple	June	June	4-5 in.	3-4 in.	Any	Edging, Naturalizing
Crocus, Cloth-of-Gold	Crocus susianus	3-4″	March	Yellow Brown	Sept.	Sept.-Oct.	3-4 in.	2-3 in.	Sun	Borders, Naturalizing
Dahlia	Dahlia sp.	3-8′	Jun.-Nov.	Many	Nov.	Feb.-Apr.	4-5 in.	3-4 ft.	Sun	Cutflower
Gladioli	Gladiolus sp.	2-3′	May-Oct.	Many	Sep.-Nov.	Dec.-May	4-5 in.	4-5 in.	Sun	Borders, Cutflower
Hyacinth, Common	Hyacinth orientalis	8-12″	March	Several	June July	Jun.-Oct.	6-7 in.	5-6 in.	Any	Borders, Bedding
Hyacinth, Grape	Muscari botryoides	4-8″	March	Blue	July-Aug.	July-Aug.	2-3 in.	3-4 in.	Sun; partial shade	Edging, Borders
Hyacinth, Star	Scilla amoena	6-9″	Feb.-Mar.	Blue	July-Sep.	July-Oct.	4-5 in.	3-5 in.	Sun; partial shade	Edging Borders
Iris, Dutch	Iris tingetana	18-24″	March	Several	Aug:-Sept.	Aug.-Nov.	2-3 in.	3-5 in.	Sun; partial shade	Borders Cutflowers
Iris, German	Iris germanica	2-3′	Mar.-Apr.	Several	Sept.	Sept.	½ to 1″	5-6 in.	Sun; partial shade	Borders Cutflowers
Iris, Japanese	Iris Kaempferi	3-4′	Apr.-May	Several	Aug.-Sept.	Aug.-Oct.	3-4 in.	5-6 in.	Sun	Borders Cutflowers

TABLE IX—Continued

Common name	Scientific name	Height	Time of bloom	Color of bloom	Time to divide	Time to plant	Depth to plant	Distance Apart to plant	Location Sun, Shade	Use
Iris, Siberian	Iris siberica	2-3′	Apr.-May	Several	Aug.-Sept.	Aug. Oct.	3-4 in.	5-6 in.	Sun	Borders Cutflowers
Lily, Day	Hemerocallis sp.	3-4′	May-Jun.	Yellow Orange	Aug.-Sept.	Aug. Oct.	4-5 in.	12-15 in.	Any	Borders Cutflowers
Lily, Goldband	Lilium auratum	3-4′	June	White Gold	July	July-Feb.	8-12 in.	12-16 in.	Sun; partial shade	Borders Cutflowers
Lily, Hanson	Lilium hansoni	4-6′	May-Jun.	Yellow Orange	July	July-Feb.	10 in.	12-16 in.	Sun; partial shade	Borders Cutflowers
Lily, Henry	Lilium henryi	5-6′	July	Orange	Aug.	Aug.-Feb.	10-12 in.	12-16 in.	Partial shade	Borders Cutflowers
Lily, Madonna	Lilium candidum	3-4′	May-Jun.	White	July	July-Sept.	4-6 in.	12-16 in.	Sun; partial shade	Borders Cutflowers
Lily, Phillipine	Lilium philippinense formosanum	3-5′	July-Oct.	White Red	Nov.	Nov.-Feb.	4-5 in.	12-16 in.	Sun; partial shade	Borders Cutflowers
Lily, Regal	Lilium regale	4-6′	May-Jun.	White	July	July-Dec.	9-12 in.	12-18 in.	Sun; partial shade	Borders Cutflower
Lily, Rubrum	Lilium speciosum rubrum	3-4′	July-Aug.	Pink	Sept.	Sep.-Jan.	10-12 in.	12-16 in.	Sun, shade	Borders Cutflowers
Lily, Spider	Lycoris sanguinea	12-24″	Sept.	Red	June-July	June-July	4 in.	4-5 in.	Sun; partial shade	Borders Cutflowers
Lily, Tiger	Lilium tigrinum	4-6′	July-Aug.	Orange Red	Sept.	Sep.-Dec.	8-10 in.	12-18 in.	Sun; partial shade	Borders Cutflowers
Lily, Turkscap	Lilium superbum	4-8′	Jun.-July	Orange Red	Aug.	Aug.-Nov.	8-10 in.	12-16 in.	Sun; partial shade	Borders
Montbretia	Tritonia crocusmaeflora	12-18″	Aug.-Sep.	Yellow Golden	Oct.-Nov.	Oct.-Feb.	3-4 in.	3-4 in.	Sun; partial shade	Borders Beds

TABLE IX—Continued

Common name	Scientific name	Height	Time of bloom	Color of bloom	Time to divide	Time to plant	Depth to plant	Distance apart to plant	Location Sun, Shade	Use
Narcissus Jonquil	Narcissi species	6-15″	Mar.-Apr.	White Yellow	July-Aug.	July-Oct.	6-8 in.	4-6 in.	Sun; partial shade	Borders, etc.
Squill, Spanish	Scilla hispanica	12-18″	Mar.-Apr.	Blue	July-Sept.	July-Oct.	4-5 in.	4-6 in.	Sun or shade	Edging Borders
Snowdrop, Snowflake	Lencojum acstivum	12-18″	March	White	July-Aug.	July-Sept.	3-4 in.	8-12 in.	Sun or shade	Borders Cutflowers
Tulip	Tulipa sp.	6-18″	Mar.-Apr.	Many	July-Aug.	July-Nov.	4-6 in.	4-6 in.	Sun; partial shade	Beds Borders
Tuberose	Polianthes tuberosa	2-3′	Jul.-Nov.	White	Nov.-Jan.	Nov.-Jan.	3-4 in.	8-10 in.	Sun	Borders Cutflowers

PLANTING CHART FOR ANNUALS

TABLE X

(Dates for Central Mississippi)

Common name	Scientific name	Time to plant	Time bloom	Color bloom	Location sun-shade	Height	Shape of plant	Best use	Good for cut-flowers
Ageratum, Mexican	Ageratum houstonianum	Feb.-Mar.	May-Oct.	Blue White	Sunny	8″-24″	Bushy	Bedding	Yes
Alyssum, Sweet	Alyssum maritimum	Feb.-Mar.	Apr.-June	White	Any	3″-8″	Spreading	Edging	No
Balsam, Garden	Impatiens balsamina	March	May-June	Many	Any	12″-18″	Erect	Border	No
Blanket Flower	Gaillardia picta	Feb.-Apr.	June-Oct.	Many	Sun	12″-18″	Bushy	Bedding	Yes
Blue Cup Flower	Nierembergia hippomanica	Feb.-Mar.	May-Oct.	Blue	Sun	8″-12″	Bushy	Edging	Fair
Calendula	Calendula officinalis	Oct.-Dec.	Feb.-Apr.	Yellow Orange	Any	18″-24″	Bushy	Bedding	Yes
Calliopsis	Calliopsis tinctoria	Jan.-Feb.	Apr.-May	Yellow Brown	Sunny	30″-36″	Bushy	Border	Yes
Cosmos	Cosmos bipinnatus	Apr.-June	Aug.-Oct.	Various	Sunny	4′-6′	Bushy	Borders	Yes
Crotolaria	Crotolaria spectabilis	Apr.-May	Aug.-Sept.	Yellow	Sunny	3′-5′	Erect	Borders	Yes
Forget-Me-Not	Anchusa	March	May-Sept.	Blue	Sunny	18″	Bushy	Border	Yes
Forget-Me-Not, Chinese	Cynoglossum amabile	Feb.-Mar.	Apr.-May	Blue	Sunny	12″-18″	Bushy	Border	Fair
Goldenwave	Calliopsis drummondi	Jan.-Feb.	Apr.-May	Yellow	Sunny	18″-24″	Bushy	Border	Yes

TABLE X—Continued

Common name	Scientific name	Time to plant	Time bloom	Color bloom	Location sun-shade	Height	Shape of plant	Best use	Good for cut-flowers
Larkspur	Delphinium ajacis	Oct.-Dec.	Apr.-May	Various	Any	18″-24″	Erect	Border	Yes
Lobelia, Slender	Lobelia gracilis	Feb.-Mar.	Apr.-May	Blue	Any	6″-8″	Trailing	Edging	No
Love-in-a-Mist	Nigella damascena	Feb.-Mar.	Apr.-May	Blue, white	Sun	12″-18″	Bushy	Border	Yes
Marigold, African	Tagetes erecta	March-June	June-Oct.	Orange Yellow	Sun	3′-4′	Erect	Border	Yes
Marigold, French	Tagetes patula	May-July	Sept.-Oct.	Yellow Brown	Sun	2′-3′	Bushy	Border	Yes
Mexican Firebush	Kochia elegans	April			Any	18″-36″	Bushy	Border	No
Nasturtium	Tropaeolum majus	Mar.-Apr.	May-June	Yellow	Any	8″-12″	Bushy	Edging	Fair
Pansy	Viola tricolor	Aug.-Sept.	Feb.-May	Many	Sun	3″-4″	Bushy	Edging	Yes
Periwinkle	Vinca rosea	Mar.-May	June-Oct.	Several	Sun	12″-18″	Bushy	Bedding	Fair
Petunia	Petunia hybrida	Feb.-Mar.	Apr.-June	Many	Any	12″-18″	Bushy	Bedding	Yes
Phlox, Annual	Phlox drummondi	Nov.-Dec.	Apr.-May	Many	Sun	12″-18″	Bushy	Border	Fair
Pin Cushion Flower	Scabiosa caucasica	Mar.-Apr.	June-Sept.	Many	Sun	18″-36″	Erect	Bedding	Yes
Poppy, California	Eschscholtzia californica	Oct.-Dec.	Apr.-May	Yellow	Sun	12″-18″	Bushy	Bedding	No
Poppy, Corn	Papaver rhoeas	Oct.-Dec.	Mar.-Apr.	Several	Any	18″-24″	Erect	Border	Fair

TABLE X—Continued

Common name	Scientific name	Time to plant	Time bloom	Color bloom	Location sun-shade	Height	Shape of plant	Best use	Good for cut-flowers
Poppy, Opium	Papaver somniferum	Oct.-Dec.	Mar.-Apr.	Salmon	Any	2′-3′	Erect	Border	Fair
Portulaca; Rose Moss	Portulaca grandiflora	Mar.-June	May-Sept.	Many	Sun	4″-6″	Trailing	Bedding	No
Ragged Robin; Cornflower	Centaurea cyanus	Oct.-Dec.	Apr.-May	Various	Any	24″-30″	Erect	Border	Yes
Sage, Scarlet	Salvia splendens	Feb.-Mar.	May-June	Red	Sun	18″-24″	Erect	Border	Fair
Snapdragon	Antirrhinum majus	Feb.-Mar.	May-Oct.	Various	Sunny	12″-30″	Bushy	Border	Yes
Strawflower	Helichrysum bracteatum	Feb.-Mar.	May-June	Many	Sun	18″-24″	Bushy	Border	Yes
Sunflower, Mexican	Tithonia diversifolia	Apr.-June	June-Oct.	Orange	Sun	6′-8′	Bushy	Border	Yes
Sweet Pea	Lathyrus odoratus	Oct.-Jan.	April-May	Many	Sun		Vine	Cutting	Yes
Tassel Flower	Cacalia coccinea	Mar.-Apr.	June-Oct.	Red	Any	18″-24″	Erect	Border	Yes
Texas Blue Bonnet	Lupinus texana	Oct.-Nov.	April-May	Blue	Sun	12″-18″	Erect	Bedding	Yes
Torenia	Torenia fortunei	Feb.-Mar.	May-Oct.	Blue	Shade	12″-15″	Bushy	Bedding	Fair
Verbena	Verbena hybrida	Feb.-Mar.	Apr.-June	Several	Sun	6″-10″	Trailing	Bedding	Fair
Zinnia	Zinnia elegans	Apr.-July	June-Oct.	Many	Sun	2′-3′	Bushy	Bedding	Yes

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CONDENSED KEY TO PLANTING LIST

DECIDUOUS TREES

1. Apricot
2. Crabapple, Flowering
3. Cypress, Bald
4. Dogwood, Flowering
5. Elm, American
6. Ginkgo, (Maidenhair Tree)
7. Gum, Sweet
8. Hackberry
9. Mimosa
10. Maple, Red
11. Oak, Pin
12. Oak, Southern Red
13. Oak, Water and Willow
14. Peach, Flowering
15. Pecan
16. Poplar, White
17. Red Bud
18. Soapberry
19. Sycamore
20. Walnut
21. Willow, Weeping

EVERGREEN TREES

22. Cedar, Red
23. Fir, Chinese
24. Cedar, Deodar
25. Holly, American
26. Magnolia, Southern
27. Oak, Live
28. Pines

BROADLEAF EVERGREEN SHRUBS

29. Abelia
30. Ardisia
31. Azalea, Indica
32. Azalea, Hinodergiri
33. Bamboo
34. Banana Shrub
35. Boxwood, Dwarf
36. Boxwood, Tree
37. Camellia, Winter Flowering
38. Camellia, Fall Flowering
39. Cape Jasmine
40. Cherry Laurel
41. Cleyera
42. Eleagnus
43. Euonymus, (Large Leaf Boxwood)
44. Euonymus, Spreading
45. Feijoa
46. Firethorn, Laland
47. Firethorn, Red Fruited
48. Holly, Chinese
49. Holly, Dwarf
50. Holly, Yaupon
51. Jasmine, Everblooming
52. Jasmine, Primrose
53. Jasmine, Winter
54. Laurestinus
55. Mahonia, (Holly Grape)
56. Nandina
57. Oleander
58. Olive, Sweet
59. Photinia, Low
60. Photinia, Scarlet
61. Pittosporum
62. Privet, Small Leaf
63. Privet, Chinese
64. Privet, Glossy
65. Privet, Japanese
66. Rosemary
67. Yucca, (Spanish Dagger)

NARROW LEAF EVERGREEN SHRUBS

68. Arborvitae, Baker's
69. Arborvitae, Berckman's
70. Arborvitae, Bonita
71. Cedar, Cannart Red
72. Cedar, Silver Red
73. Juniper, Pfitzer
74. Juniper, Savin
75. Juniper, Virginal
76. Yew, Japanese

FLOWERING SHRUBS

77. Almond, Flowering
78. Althea
79. Barberry, Purple Leaf
80. Butterfly Bush
81. Chaste-Tree
82. Crape Mrytle
83. Deutzia, Fuzzy
84. Deutzia, Lemoine
85. Goldenbell, Greenstem
86. Goldenbell, Showy
87. Honeysuckle, Tatarian
88. Honeysuckle, Winter
89. Hydrangea, House
90. Magnolia, Japanese Saucer
91. Mock Orange, (English Dogwood)
92. Pearlbush
93. Pomegranate, Flowering
94. Quince, Flowering
95. Sage, Autumn
96. Snowball, Japanese
97. Spirea, Anthony Waterer
98. Spirea, Bridal Wreath
99. Spirea, Reeves
100. Spirea, Thunberg
101. Spirea, Vanhout
102. Weigela

VINES

103. Clematis, Autumn
104. Clematis, Jackman
105. Fig Vine
106. Honeysuckle, Woodbine
107. Ivy, Boston
108. Ivy, English
109. Jasmine, Yellow
110. Jasmine, Star
111. Kudzu
112. Rose of Montana
113. Scarlet Berry
114. Trumpet-Creeper
115. Vinca, (Big Leaf)
116. Vinca (Myrtle)
117. Virginia Creeper
118. Wistaria

NATIVE SHRUBS

119. Alder, Smooth
120. Buckeye, Red
121. Buckwheat Tree; Titi
122. Button Bush; Button Willow
123. Chokeberry, Red
124. Dogwood, Roughleaf
125. Dogwood, Silky; Kinnikinnik
126. Elder, American
127. Fetter Bush
128. Fringe Tree; Grandsire Graybeard
129. Gallberry; Inkberry; Winterberry
130. Holly, Deciduous
131. Hydrangea, Oakleaf
132. Indigo, False
133. Jersey Tea; Red Root
134. Laurel, Mountain
135. Leatherwood
136. Mulberry, French
137. Myrtle, Wax; Candle Berry
138. Palmetto
139. Pinxter Flower; Honeysuckle
140. Snowball, American
141. Stewartia
142. St. John's Wort
143. Stink Bush; Anise Tree; Flintleaf
144. Strawberry Bush
145. Sumac, Dwarf; Sumac Shining
146. Sumac, Smooth
147. Sumac, Staghorn
148. Sweet Shrub
149. Witch-Hazel
150. Yaupon

151. ____________________

152. ____________________

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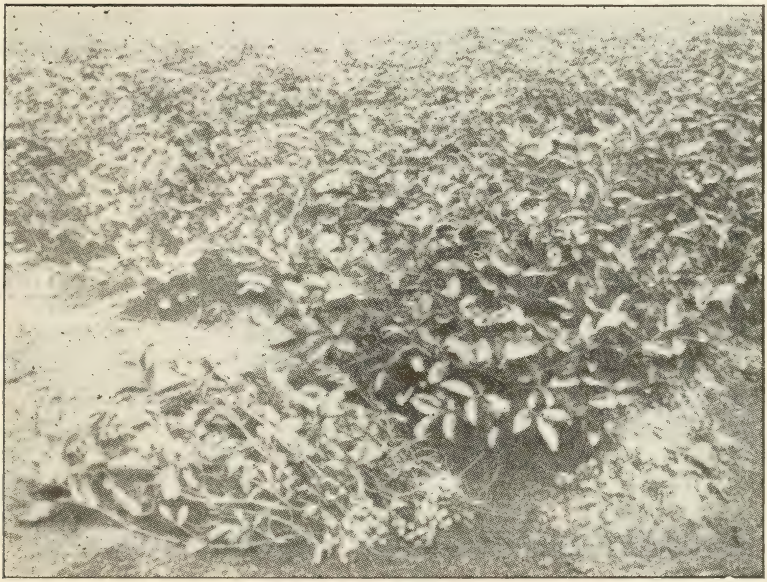
BULLETIN No. 341 APRIL 1940

PEANUT PRODUCTION



Compiled by

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Jointly Representing

Mississippi Agricultural Experiment Station

and

Mississippi State Vocational Board

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State College, Mississippi

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INTRODUCTION

In the past peanut production has not been very widely distributed in Mississippi, but during the last few years considerable interest has been manifested in several sections of the State toward the expansion of peanut production. Along with this increasing interest in peanut production there is a demand for information by agricultural workers and by farmers on the best methods of producing peanuts.

There has been only a limited amount of experimental work conducted by the Mississippi Experiment Station with peanuts, which made it necessary to seek experimental and other reliable information from other states in preparing this compilation on peanut production. Therefore the experimental information in this compilation includes appropriate material from a number of peanut producing states, and is supplemented with general information pertaining to the practices of peanut growers from a peanut producing area. Much information was secured from farm surveys made for the purpose of this publication on twenty-four farms in Southeast Alabama. The practices used on these twenty-four farms were summarized and used in this compilation to supplement experimental information.

Experiment station results indicate a wide variation in the response of peanuts to fertilization, which makes it difficult to know what is the best practice to follow, and while certain prevailing farm practices are cited, there is no way of knowing that the practices used by the peanut growers of Southeast Alabama are the best practices to use. The available experimental information, and the practices used in Southeast Alabama are presented in this compilation to be used as a guide in the production of peanuts.

It is suggested that additional experimental work conducted by peanut growers may reveal some very helpful findings on certain phases of peanut production on which there is a very limited amount of reliable information available.

Farm Organization

The success of peanut production as well as any other farm enterprise will depend to a considerable extent on how well it fits into the general farm organization. It is a known fact that there are always certain risks and hazards involved with the introduction of a new enterprise. However, in certain areas of Alabama, North Carolina, Virginia, Georgia, and Texas the peanut crop occupies a very important place in the farm organization, and supplies a great deal of the farm income of these areas.

The 24 farm surveys, referred to in the introduction, were made in Houston and Coffee counties in the heart of Southeast Alabama's peanut producing area. Peanuts occupy an important place in the farm organization and income of these counties.

Houston and Coffee counties have a cotton acreage allottment of 92,700 acres, and an allotment of 70,500 acres for harvest peanuts. These two acreages equal 40.2% of the total cultivated land. In addition to the harvest peanuts, 61,000 acres are planted solid in peanuts and 60,000 acres a row of corn and a row of peanuts; these peanuts are harvested with hogs produced for home use and for the market.

Houston and Coffee counties have 406,000 acres in cultivation. With the farm organization prevailing in these counties, over 50% of the cultivated land is producing cash income. In making the farm surveys on the 24 farms of these two counties the farming system used on each farm was secured including crops grown, livestock population and the acreage, yield, and sales from each enterprise. The twenty-four surveys were summarized and show the following:

SUMMARY OF 24 FARMS SURVEYED IN SOUTHEAST ALABAMA, JANUARY 1940

By E. P. Rawson and H. O. West

Total acreage in farms	6085	Average per farm	253.5
Total acreage in cultivation	3663	Average per farm	152.6

Crop	Total of 24 Farms			Average Per Farm		
	Acreage or head	Production	Sales $	Acreage or head	Production	Sales $
Cotton	Acres 780	517 bales	* $22,467.50	32.5	21.5 bales	$936.52
Corn	952	15324 bu.	80.00	39.6	638.5 bu.	3.33
Peanuts (harvested)	507	289 tons	** 14,921.00	21.1	12.04 tons	621.70
Peanuts (hogged)	653	lbs. pork 194115	11,687.00	28.4	lbs. pork 8088	478.60
Corn and Peanuts	289	3107 bu. 45650 lbs pk	0 2,282.50	12.0	129 bu. 1902 lbs pk.	95.00
Oats	305	Grain and hay	175.00	12.7	Grain and hay	7.29
Soybeans	45	lbs. pork 9100	455.00	1.87	lbs. pork 380	19.00
Miscellaneous crops	45		910.00	1.87		38.00
Hogs	Head 1655	lbs. pork 310,175	*** 17,237.00	69.0	lbs. pork 12924	718.20
Beef cattle	53		1,800.00	2.2		75.00
Dairying	64		3,182.50	2.66		132.60
Poultry			587.00			24.40
A.A.A. Payment			9,053.00			377.20
	TOTAL INCOME		$70,413.00	AVERAGE INCOME PER FARM		$2933.90

*8.69c per lb. lint cotton

**$51.63 per ton

***5.55c per lb.

The farm surveys were made at random in Houston and Coffee counties, Alabama. These farms were not selected as representing the best or poorest in the area. The surveys were made on farms where the owners were found at home.

The soils on these farms are Greenville, Orangeburg, Norfolk, Ruston, Savannah, Luverne and Susquehanna. The class is sand to clay, with a high percent of fine sandy loam. The soils are fairly fertile, producing very satisfactory yields of most crops.

In grouping the farms in high, medium, and low acreage groups, the high group of 8 farms averaged 481 acres in the farms with 284 acres in cultivation; the medium group of 8 farms averaged 218 acres total with 131 acres in cultivation; and the low group of 8 farms averaged 61 acres total with 42 acres in cultivation. The per farm income on these farms ranged from $293.00 to $12,800.00.

This study is presented here to show how peanuts fit into the general cropping system and the position they occupy in supplying income, and to serve as a guide as to what to expect with a similar cropping system and similar conditions.

Soils and Climate

Peanuts can be produced on practically all of the soils of Mississippi. The best quality and largest yields of marketable peanuts are produced on the well drained, light sandy loam soils. The dark colored soils stain the hulls of the peanuts, and may affect the price secured, depending on the use made of the nuts. Stained pods are not objectionable for shelling stock or oil purposes. Soils which pack or bake easily are not well suited for peanuts, as it is hard for the "pegs" or stems to enter such soils. The peg or stem must enter the soil to form a peanut. When the peanuts are grown for hogs, any kind of soil that is loose and well drained may be used. Poorly drained or sour soils are not generally desirable for peanuts. The North Carolina experiment station has found that peanuts produce higher yields per acre on soils with a pH above 5.0.

Peanuts will adapt themselves to a wider range of climate if soil conditions are favorable, than almost any other southern crop. The climatic requirements of the peanut are: a growing season of 100 to 140 days without frost, moderate rainfall during the growing period, an abundance of sunshine, and a relatively high temperature. Best results are secured under conditions where the normal annual rainfall is from 42 to 54 inches. Peanuts are frequently grown under irrigation; however, fair yields have been made without irrigation where the annual rainfall is less than 19 inches. On the other hand, good crops have been produced on low, bottom soils with 54 to 60 inches of rainfall. Peanuts do not grow well at high elevations, even when there are more than 130 days between frosts, as the cool nights in these localities prevent proper development of the crop.

The soils in the peanut section of Southeast Alabama are in general the sandy type, with many different soil series usually similar to and often identical with Mississippi soil series. In the production of peanuts, as any other crop, the more fertile the soil the higher the yield of peanuts per acre.

References: Virginia Agricultural Experiment Station Bulletin 218, "Peanut Culture," pages 4 and 5, January 1918, Blacksburg, Virginia.

Farm surveys of Southeast Alabama.

North Carolina Experiment Station Agronomy Information Circular 123, January 1940, Raleigh, North Carolina.

Farmers' Bulletin 1656, "Peanut Growing", pages 1 and 2, February 1931.

Land Preparation

Proper land preparation for peanuts is important. Some farmers believe in fall plowing and consider it to be the most satisfactory way of getting a good seedbed. In many sections of Mississippi soil erosion must be considered in connection with fall plowing. Many times fall plowing causes an excessive amount of erosion and if this practice is carried out for a few years a field or given area may be completely ruined. However, most peanut land is broken six to eight weeks before planting time.

The farmers interviewed in Southeast Alabama begin breaking their land in December and continue plowing during suitable weather until their land is broken. By doing this the grass and litter on the ground is given time to decay before planting time. If the land is not broken, usually a disc harrow is used in November or early December to cut the litter into the soil to speed up the decaying process. In this section all peanut land is flat broken, and allowed to stand until just before planting time.

The land should be clean and free from trash at planting time. A good seed bed will help to get a good stand, and lower the cost of cultivation. A rough seed bed will cause the planter and cultivating implements to clog. The operator will waste considerable time trying to get the implements to work, and drag up a lot of plants, resulting in an uneven stand and lower production. By breaking or discing early enough to allow the litter to decay and to provide a firm seedbed at planting time these inconveniences may be overcome.

About ten days before planting time, the farmers of Southeast Alabama bed their peanut land with a middle buster one furrow to the row. It is allowed to stand this way until ready to plant.

References: Farmers surveyed in Southeast Alabama. Tom Houston Peanut Company Bulletin.

Varieties

In planting any crop a decision must be made as to what variety to use. Every one is interested in securing the variety that will give the largest yield or cash return. There are several varieties of peanuts, but two main types: the bunch and runners. The bunch type usually mature quite a bit earlier than the runner type. Bunch type peanuts must be harvested immediately when mature, whereas the runner type may remain in the soil for a considerable period without injury.

In studying a summary of the farm surveys made in Southeast Alabama it was found that a large percentage of the peanuts planted are North Carolina runners. Taking the entire Alabama peanut belt, it is estimated that 85 percent of the peanuts are North Carolina runners and 15 percent Spanish. Very few Spanish peanuts are harvested in Alabama because the farmers say that they have to be harvested the last of August or first of September during the peak of the cotton picking season. Therefore most Spanish peanuts are hogged in Alabama and the runners are harvested for the market. These farmers report little difference in returns from different varieties. The Spanish usually bring more money per ton but the runners produce enough more per acre to make up for the difference in price.

In selecting a variety it would be wise to consider the use to be made of the peanuts and the time and method of harvesting, to avoid a labor overload at harvesting time.

Peanut Variety Test

Conducted by: Georgia Coastal Plains Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1928-1937.

Purpose: To determine the best variety of peanuts to grow.

Soil: Tifton sandy loam.

Procedure and Conditions: This test was run in two replications on 1.40 acre plots. The plants were spaced 6 inches apart in rows 3.3 feet wide. The fertilizer was applied at planting time, stirred in the furrow. The average planting date was April 10.

Spanish and Improved Spanish are bunch varieties grown mostly for market, although sometimes used for early hog grazing. These two varieties are easy to harvest, have a high shelling percentage and are in good market demand. Spanish peanuts sprout badly soon after maturing and for this reason are not suited for late hog grazing. North Carolina Runner makes a high yield, keeps well in the soil after maturing and is used largely for hog grazing. This variety is harder to harvest than Spanish, has a lower shelling percentage and brings a lower price on most markets.

Results:

VARIETY TEST WITH PEANUTS

400 Lbs. 2-10-4** (Ammonia, phosphoric acid and potash)

Variety	Pounds Per Acre											Shelling % 1928-37
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	10 Yr. Av.	
North Carolina	1242	1915	1634	1918	1960	2135	1665	2180	1757	2165	1858	70.2
McGovern	1130	1762	1463	1911	1844	2090	1700	2050	1555	2180	1769	70.3
Improved Spanish	1604	1320	1190	1493	1428	1932	1259	1599	1520	1890	1523	67.9
Spanish	1557	685	1130	1493	1640	2205	1175	1448	1457	2058	1484	76.3
Chapman's Pride	1612	917	899	1553	1311	1810	1190	1443	1144	1855	1373	65.0
Valencia	882	485	462	893	986	1590	980	....	....	....	897*	60.0

*7 year average

**2-10-4 amonia, phosphoric acid, potash

Reference: Fourteenth, Fifteenth, Sixteenth, Seventeenth and Eighteenth Annual Reports of the Georgia Coastal Plain Station, Tifton, Georgia.

Variety Test with Peanuts at Angleton, Texas

Conducted by: Texas Agricultural Experiment Station.

Conducted at: Angleton Station, Angleton, Texas.

Period: 1915-1933.

Purpose: To determine the best variety of peanuts to plant at Angleton, Texas.

Soil: Light colored phase of Lake Charles clay and clay loam soils. The Lake Charles soils are black to dark gray in color and range from clay to fine sandy loam in texture, although the clay is the most extensive type. These soils have dark-gray, heavy clay subsoils. They contain a larger proportion of clay than is desirable from the standpoint of ease in harvesting peanuts.

Procedure and Conditions: The peanuts in these experiments were planted in three-foot rows. During the period of the experiment the size of plot ranged from 1/44 to 1/11 of an acre, but since 1927 the plots have been 1/22 of an acre in size, consisting of two rows 330 feet long.

In these studies the peanuts followed corn in the four-year rotation of corn, cotton, corn and peanuts. During the last six years, however, grain sorghum occasionally replaced the corn in the rotation. After harvesting, the stalks of cotton, corn, and the grain sorghum usually were plowed under in the fall or winter as conditions permitted. The entire peanut crop, including vines and nuts, was removed from the land in harvesting.

Generally the peanuts were planted flat on land that had been plowed the preceding fall or winter. In some years, however, low beds were formed on the plowed land with a cultivator and the peanuts planted on these beds. Prior to 1920 the seed was dropped by hand but since that time the seed has been planted with a duplex hopper attachment on a lister planter. In the spacing tests the peanuts were dropped by hand.

As a rule, the small-podded varieties were not shelled before planting but the pods were broken crosswise so that a single kernel was dropped in each hill. The large-podded varieties, however, were shelled because the kernels usually do not fill the pod and have a tendency to drop out if the pods are broken, so that an empty hull would not be planted instead of a kernel.

The date of planting ranged from March 15 to June 5, but usually the peanuts were planted the latter part of April or first part of May.

Occasionally it was necessary to replant the peanuts because of thin stands resulting from low germination of seed, from unfavorable weather conditions immediately after planting, or from damage caused by rodents. Further, the final stands obtained were poor in most years.

The peanuts were given about the same cultivation as cotton. Shallow clean cultivation was practiced. From three to five cultivations were given during the growing season. As a rule the peanuts were hoed twice and occasionally three times, which was one more hoeing than was given cotton.

The peanuts were dug with a walking mouldboard plow. As a rule the row was barred off and then the center strip containing the plants was turned over. The vines were then shaken out of the soil with a pitchfork and all of the plants on each plot, consisting of two or three rows, were heaped together for drying.

Miscellaneous: The average yearly rainfall at Texas Substation No. 3, located at Angleton in the Gulf Coast Prairie, approximately 18 miles from the Gulf of Mexico, was 44.53 inches for the 19 years, 1915-1933. While the monthly and yearly rainfall is ample, the distribution often varies widely in individual months and years.

The temperature during the growing season is favorable to the growth of peanuts. The mean maximum temperature ranged from 78.4° F. in April to 92.2° in August. The mean maximum temperature ranged from 57.8° F. in April to 71.9° in July.

Results:

YIELD OF PEANUTS IN POUNDS PER ACRE IN THE VARIETY TEST

Year	Small-pod. Varieties*		Large-podded varieties**				
	Macspan	Spanish	Runner Carolina	Runner Virginia	Virginia Bunch	Valencia	Tennessee Red
1915		1434			931	1938	1426
1916		6048		4011		2926	2605
1917		1890		2363		1288	1701
1918		810		499		381	409
1919		87		128	95	68	
1920		1500			1302	484	717
1921		672		480	576	451	660
1922	2391	1878		873	2233	1549	671
1924	528	309		486	1434	1085	836
1926		210		1269	700	706	506
1927	420	696	1159	356	805	257	216
1928	1158	1053	673	1054	739	552	455
1929	1740	1596	1157	1489	1167	810	1078
1930	1386	1842	2328	1085	1428	713	614
1931	1434	1152	979	1060	867	636	552
1932	1470	1449	968	519	497	447	326
1933	1422	1089	988	836	295	389	440
Average 1927-33	1290	1268	1179	914	843	543	526
Average 1927-33 Bu. per A.	43.0	42.3	53.6	41.6	38.3	24.7	23.9

*A bushel weighs 30 pounds

**A bushel weighs 22 pounds

Reference: Texas Agricultural Experiment Station Bulletin 503, "Peanut Growing in the Gulf Coast Prairie of Texas," pages 6, 7, 8, 9 and 11, table 3, College Station, Texas, January 1935.

Peanut Variety Tests in Texas

Conducted by: Texas Agricultural Experiment Station.

Conducted at: Beeville, Troup, Angleton, Lubbock, and Nacogdoches, Texas.

Period: 1 to 10 years.

Purpose: To test the different varieties of peanuts.

Procedure and Conditions: Yields will vary with the season and the fertility of the soil. The peanut if grown continuously on land with both the forage and nuts removed, will soon deplete the soil, restulting in greatly reduced yields.

Variety tests, in which both nut and forage yields were recorded, have been conducted at six of the Texas Substations. Results of these tests are summarized below.

Results:

AVERAGE YIELD PER ACRE IN BUSHELS OF NUTS AND TONS OF FORAGE OF PEANUT VARIETIES TESTS AT FIVE SUBSTATIONS IN TEXAS

Station	Years Tested	Spanish		Tenn. Red		Valencia		Va. Runner		Va. Bunch	
		Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage
Beeville	1	46.12	2.79	24.84	2.41	28.40	2.72	37.91	2.50	18.57	1.86
Troup	8	34.52	1.39	23.79	1.16	54.60	1.70	28.52	1.35	....	----
Angleton	10	53.52	1.56	*30.37	*1.54	46.21	1.14	....	....	64.27	1.07
Lubbock	1	23.30	.35	21.82	.33	....	......	22.73	.30	21.36	.18
Nacogdoches	1	....	2.18	....	1.89	....	......	....	1.93	....	1.52

*4 years

Reference: Texas Agricultural Experiment Station Bulletin 381, "Peanuts in Texas," pages 16 and 17, table 6, May 1928, College Station, Texas.

Seed Selection

Pure, unmixed, high yielding planting seed are important in peanut production. Two kinds of peanuts mixed together are hard to sell. If the seed are mixed the whole crop will be mixed.

A high price paid for good seed may make more money than a low price paid for poor seed. The use of poor seed will materially reduce the value of the crop. A good stand cannot be gotten with poor seed, and peanuts cannot be satisfactorily replanted because the replants will not have time to mature before the regular planting is ready to dig. Figure 1 shows what happens to the stand when good and poor seed are planted.

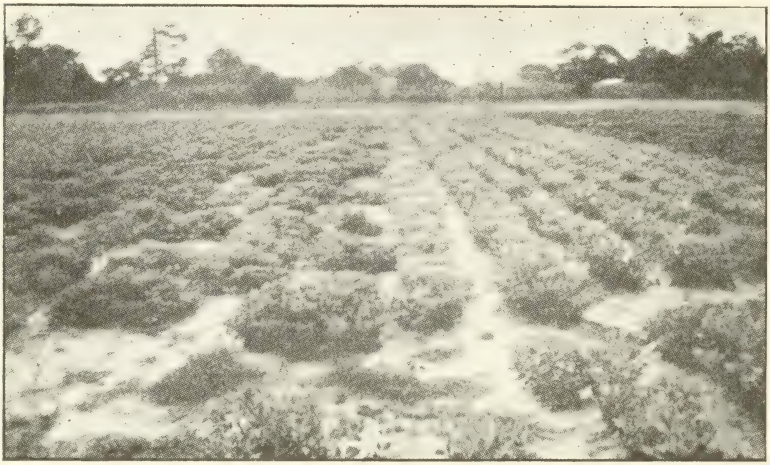

Figure 1—Poor seed on the left. Good seed planted on the right.

The peanut, perhaps more than any other plant, responds to care in selection of seed. The seed should be saved only from mature plants and those having the greatest number of sound, mature pods. The part of the crop intended for seed should be thoroughly mature, and after digging should be allowed to cure until the foliage is perfectly dry before stacking. Being allowed to dry rapidly in this way, a much higher percentage of germination is usually obtained. From the seed saved in this way a few of the largest, heaviest pods should be selected to plant a seed patch for the next year. By following a system of seed selection the size nuts of any variety may be increased, resulting in a better price for the crop. Seed selection is one of the phases of peanut growing which has been seriously neglected. Germination tests should always be run. Germination tests may be made by putting the seed in moist cotton which should be kept at a temperature of 75° Fahrenheit.

All seed should be gone through, and all pops and immature seed removed. A good stand of peanuts is very essential toward getting a satisfactory yield. Many peanut failures are due to not having a stand on the land planted. About as much work is required to work a half stand as a perfect stand of peanuts.

References: Tom Huston Peanut Company Bulletin, "Peanuts, Culture and Marketing of the White Spanish Variety in the Southeastern States," pages 10 and 11, Second Edition 1931, Columbus, Georgia.

Virginia Agricultural Experiment Station Bulletin 218, "Peanut Culture," page 8, Blacksburg, Virginia, January 1918.

Preparation of Seed for Planting

The preparation of planting seed has a direct bearing on stand and yield. The seed should be examined for mixture to be certain of planting only one variety, especially if the peanuts are to be harvested for the market. In removing seed mixtures, also pick out immature nuts, leaving only the well matured nuts for planting.

When the Spanish variety is used it is best to plant in the shell. A stand can be secured much quicker by soaking the peanuts, in the shell, over night, in water before planting. Shelled Spanish peanuts do not seem to germinate very well, resulting in uneven stands, which lowers the yield and in some cases the quality of peanuts produced. If the runner varieties of peanuts are planted it is necessary that the seed be shelled, and it is much better to hand shell them than with a machine. The hull of the runner varieties seem to be tougher and nearly water proof which necessitates shelling. The runner varieties can not be planted in the shell very well with a planter, due to the size.

The peanut growers of Southeast Alabama plant approximately 85% runner varieties. Due to this most of their peanuts are shelled for planting. The general practice is to shell peanut planting seed during the winter months when weather conditions prevent other farm work.

Very little experimental work has been conducted to show the effect of seed preparation on stand and yield of peanuts. Due to this fact a peanut grower should experiment with different methods of seed preparation and determine the most satisfactory method to use on a particular farm.

The Effect of Methods of Preparing Seed on Yields of Peanuts

Conducted by: Texas Agricultural Experiment Station.

Conducted at: Substation No. 11 at Nacogdoches, Texas.

Period: One year.

Purpose: To compare the different methods of preparing seed for planting.

Soil: Orangeburg fine sandy loam.

Procedure and Conditions: Peanuts can be prepared for planting by hulling, by cracking the hulls, or they can be planted whole. In the eastern part of the State, which is heavily timbered, it is best to either crack or shell the peanuts before planting; otherwise a large part of the stand will be destroyed by birds while the plants are emerging from the soil. Breaking the pod into two pieces will give practically the same results as hulling. A one-year experiment at Substation No. 11, Nacogdoches, shows only a slight difference in the yields of nuts and forage between the cracked hull, and the whole hull, in the thirty-six-inch rows, while with the eighteen-inch rows, the same yields were obtained from both methods of preparing the seed.

Results:

A COMPARISON OF TWO METHODS OF PREPARING SEED. YIELDS ARE REPORTED AS BUSHELS OF NUTS AND TONS OF FORAGE

	36-inch Rows		18-inch Rows		Average	
	Nuts	Forage	Nuts	Forage	Nuts	Forage
Not hulled	34	1.57	37	1.53	35.5	1.55
Cracked hull	36	1.60	37	1.53	36.5	1.56

Reference: Texas Agricultural Experiment Station Bulletin 381, "Peanuts in Texas," pages 9 and 10, table 2, May 1928, College Station, Texas.

Fertilizers for Peanuts

The success of any farmer depends a great deal on the economical production of the highest yields of crops or livestock. A large percent of the farms in Mississippi require the application of plant food in some form to produce crops of sufficient volume to be economical.

Peanuts are not different to other crops, in that plant food must be supplied if satisfactory yields are made. The response of peanuts to fertilization is not, however, as consistent as the response of other crops to fertilizers. The effect of the peanut on the soil is not clearly understood, especially if the peanuts are harvested. According to experimental work by the Alabama Experiment Station, peanuts harvested on the same land for a number of years practically ruins the soil for production of crops. The peanut growers of Southeast Alabama say that peanuts should never be harvested on the same land two years in succession.

In some instances peanuts respond very little to the application of fertilizer, especially on very fertile soil or following a highly fertilized crop. Experiment station bulletins indicate that the greatest fertilizer needs of the peanut are phosphorus, lime, and potash.

The experimental work with peanuts is very limited. A number of the tests have been conducted for a short period and the results may not be conclusive. In studying the information this fact should be considered.

The Effect of Various Fertilizers on Germination and Yield of Peanuts

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Holland, Virginia.

Period: One year, 1931.

Purpose: To study the effect of the various elements of plant food on the yield of peanuts.

Soil: Onslow fine sandy loam. The top soil is dark gray sandy loam and the subsoil is a pale yellow sandy loam slightly heavier than the surface layer. The land is nearly flat and ditches are depended upon to carry off the surface water. In wet weather the soil water rises to within a few inches of the surface. This type of soil is not so well adapted to the growing of peanuts as is Norfolk sandy loam.

Procedure and Conditions: This experiment was conducted in a two-year rotation of peanuts and corn. The corn land was seeded to rye at the last cultivation, and the peanut land was seeded to crimson clover at the time of digging as cover and green manure crops.

The experiment was planned so that all plots receiving nitrogen received it at the rate of 10 pounds of ammonia to the acre; those receiving phosphoric acid received it at the rate of 40 pounds to the acre; and those receiving potash received it at the rate of 40 pounds to the acre. Gypsum was used where indicated at the rate of 160 pounds to the acre, which is approximately equivalent to the amount contained in 250 pounds of 16 per cent superphosphate. When the materials were applied before planting, they were distributed in the row and bedded upon immediately. The seed were planted on the beds the following day. When used as top dressings, the fertilizers were applied as soon as practicable after the plants were up.

Results:

THE EFFECT OF VARIOUS FERTILIZERS ON GERMINATION AND YIELD OF PEANUTS FOR ONE YEAR 1931

Plot No.	Material and Time of Application	Stand in 14 days	Final Stand	Yield of Unshelled Peanuts per Acre
		Percent	Percent	Pounds
1	40 lbs. potash from kainit before planting	48	73	1200
2	40 lbs. potash from muriate before planting	85	90	1420
3	40 lbs. potash from sulphate before planting	88	91	1450
4	Check	91	95	920
5	40 lbs. potash from sulphate of potash-magnesia before planting	85	91	1360
6	40 lbs. potash from kainit top dressing	89	93	1400
7	40 lbs. potash from muriate top dressing	84	90	1250
8	Check	90	95	880
9	500 lbs. 2-8-8 before planting	62	81	1250
10	500 lbs. 2-8-2 before planting, 60 lbs. muriate potash top dressing	81	91	1320
11	143 lbs. cottonseed meal before planting	90	93	890
12	Check	90	95	850
13	250 lbs. superphosphate before planting	88	92	1300
14	250 lbs. superphosphate and 165 lbs. gypsum before planting	85	90	1180
15	165 lbs. gypsum before planting	83	92	960

Reference: Virginia Agricultural Experiment Station Bulletin 284, "Experiments with Lime, Fertilizers, and Varieties of Field Crops in the Cotton and Peanut Section of Virginia," pages 3, 12 and 13, table 6, Blacksburg, Virginia, May 1932.

Yields of Peanuts Show Response to Fertilization

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: Farms of B. T. Clayton and E. H. Mosby in cooperation with J. B. McInnis, vocational agriculture teacher of Lauderdale High School, Lauderdale, Mississippi.

Period: 1939.

Purpose: To determine the response of peanuts to fertilizer.

Soil: B. T. Clayton farm—Norfolk loamy sand.
E. H. Mosby farm—Ruston loamy sand.

Procedure and Conditions: The soil on the B. T. Clayton farm will probably make 250 pounds of lint cotton with 300 pounds of 4-8-4 during an average year. The soil on the E. H. Mosby farm was very poor, having been discarded for other crops.

Results:

B. T. CLAYTON FARM—LAUDERDALE, MISSISSIPPI

Treatment	Yield in Pounds Peanuts Per Acre
400 pounds 8-8-4	967
400 pounds 4-8-4	789
400 pounds 0-8-4	1126
400 pounds 4-4-4	802
400 pounds 4-0-4	760
400 pounds 4-8-0	764
400 pounds 4-8-4 (P2O5 from basic slag	1161
400 pounds 4-8-4 (top dressed with 400 pounds Gypsum)	738
400 pounds Gypsum (top dressed)	742
1250 pounds lime	900
No fertilizer	617

E. H. MOSBY FARM—LAUDERDALE, MISSISSIPPI

Treatment	Yield in Pounds Peanuts Per Acre
400 pounds 8-8-4	522
400 pounds 4-8-4	443
400 pounds 4-8-4 (P2O5 from basic slag)	677
400 pounds 0-8-4	524
400 pounds 4-4-4	433
400 pounds 4-0-4	457
400 pounds Gypsum (top dressed)	469
No fertilizer	368

Reference: Mississippi Farm Research, Volume 2, Number 12, page 7, State College, Mississippi, December 1939.

Fertilizer Formula Test with Peanuts

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1928-1937.

Purpose: To determine the best fertilizer formula for peanuts.

Soil: Tifton sandy loam.

Procedure and Conditions: This test was run on plots 1/40 acres in size. The rows were 3.3 feet wide and the plants were spaced 6 inches. This spacing is wider than recommended.

The fertilizer was stirred in the furrow at the time of planting. The average planting date was April 10. Spanish peanuts were used. The test was run in duplicate.

Where peanuts follow a crop that has received little or no fertilizer, an application of 200 to 300 pounds of a complete fertilizer that is low in nitrogen should give profitable increases in yield. A light application of fertilizer also reduces the drain on plant food elements of the soil often evident where peanuts are harvested for market. Where peanuts are planted in a rotation with well fertilized crops, good yields should be obtained without the use of fertilizer. In that case fertilizer is applied to crops more responsive to fertilization and peanuts are followed to use residual plant food.

Other data show that most of the phosphorus, much of the potash, but little of the nitrogen remain in the soil after a well fertilized cotton crop. The peanut, being a legume, draws most of the nitrogen from the air, but draws upon the soil for phosphoric acid, potash and lime.

Results:

FERTILIZER FORMULA TEST WITH PEANUTS

400 Pounds of Fertilizer Per Acre Applied Previous to Planting

Formula	Yield in Unhulled Nuts in Pounds Per Acre										
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Average 1928-1937
Phosphoric Acid Series											
2-0-4	1065	835	565	1280	1323	2095	1377	1577	1237	1699	1305
2-6-4	1215	710	605	1370	1535	2165	1392	1467	1333	1710	1350
2-8-4	1330	910	640	1350	1419	1985	1340	1460	1265	1672	1337
2-10-4	1260	790	730	1390	1510	2040	1309	1572	1245	1725	1357
2-12-4	1330	625	560	1410	1442	2075	1267	1482	1290	1720	1320
2-16-4	1370	585	520	1390	1410	2050	1287	1558	1230	1742	1314
Ammonia Series											
0-10-4	1195	790	612	1220	1341	1955	1260	1375	1225	1733	1271
2-10-4	1015	855	645	1410	1429	2095	1280	1487	1310	1745	1327
4-10-4	1060	915	660	1490	1561	2040	1373	1538	1255	1588	1348
6-10-4	1185	980	630	1455	1620	2075	1357	1600	1290	1865	1406
8-10-4	1165	910	650	1490	1544	2180	1360	1652	1385	1888	1422
Potash Series											
2-10-0	1085	725	565	1330	1399	1775	1303	1502	1300	1683	1267
2-10-2	1140	705	622	1350	1501	1955	1330	1462	1298	1800	1316
2-10-4	1290	825	625	1310	1489	2065	1333	1553	1290	1782	1356
2-10-6	1400	895	672	1320	1465	2265	1372	1625	1280	1792	1409
2-10-8	1315	740	745	1370	1426	2420	1346	1590	1250	1854	1406
No fertilizer	1025	668	484	1125	1066	1680	1260	1261	1210	1555	1133

Reference: Annual Reports Georgia Coastal Plain Experiment Station, Tifton, Georgia.

Effect of Fertilizers on Yield of Peanuts

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Holland, Virginia.

Period: 1914-1921.

Purpose: To determine the effect of fertilizers on yield of peanuts.

Procedure and Conditions: In the experiments here reported peanuts have received no fertilizer as a direct application, hence only the residual effect of that used for cotton the previous year are shown. It is believed that when other crops in the rotation receive applications of fertilizer it is necessary to apply only phosphorus to the peanut crop. Our experimental results show that large quantities of nitrogen used on a fairly fertile soil always produce a poor quality of peanuts. At the same time the yield is not materially increased. The use of this element causes the vines to grow too rapidly and consequently the axils, where the flowers are formed are too far apart. It also causes a profuse growth of vine and a corresponding lateness of maturity. When the vines are killed by frost there are always a number of immature nuts or "saps" which are of a dark color and require much longer to dry than fully matured nuts. These results are not applicable under all conditions, however. On light sandy soils, which are deficient in organic matter, an application of nitrogen often pays, especially when used in connection with phosphoric acid. When nitrogen is used it should always be derived from some organic material, cottonseed meal probably being the best source of nitrogen.

Phosphorus seems to give better results than any other elements as a peanut fertilizer. It hastens maturity and usually produces nuts with firm, well-filled white hulls, which are the qualities so much desired by the cleaner.

Potash, like nitrogen, produces dark-hulled nuts of a poor quality, especially when used on the darker soils. This element gives good results on the sandier type of soils.

In order to fertilize peanuts judiciously it is necessary to study the condition of the particular soil and supply those elements which seem to be lacking. If the soil will produce a fair growth of vines, the use of nitrogen and potash can be eliminated. If the soil is light and sandy and lacking in organic matter, a complete fertilizer will pay. A complete fertilizer analyzing 2 percent nitrogen, 8 percent phosphoric acid, and 4 percent potash with all of the nitrogen from an organic source is recommended for general use on thin, sandy soils. This may be used at rates varying from 300 pounds to 500 pounds to the acre, depending upon the fertility of the soil.

Superphosphate at rates varying from 300 to 500 pounds to the acre to hasten maturity is the only fertilizer recommended for this crop on heavy, fertile soils.

Results:

EFFECTS OF FERTILIZERS ON PEANUTS

Plot No.	Materials used in pounds per acre	Yield in Pounds of Peanuts Per Acre								Av. Yield 1914-1921
		1914	1915	1916	1917	1918	1919	1920	1921	
1	240 dried blood	1540	1180	1480	560	1080	1300	600	1600	1167.5
2	500 acid phosphate	1360	1680	1660	660	1160	2080	720	1520	1355.0
3	200 muriate of potash	1600	1160	1600	680	1160	1540	1000	2000	1342.5
4	No fertilizer	1400	700	1820	500	720	1780	800	2100	1227.5
5	(240 dried blood (200 muriate of potash	1500	1400	1720	640	1240	1580	1200	2260	1442.5
6	(500 acid phosphate (200 muriate of potash	1760	1260	1900	700	1120	1720	1280	2160	1387.5
7	(240 dried blood (500 acid phosphate	2400	1200	1960	540	860	2400	1000	2000	1545.0
8	(240 dried blood (200 muriate of potash (500 acid phosphate	1240	1480	2060	580	980	2000	1440	2300	1510.0
9	(480 dried blood (400 muriate of potash (1000 acid phosphate	2920	1080	1500	560	1260	1840	1300	2200	1582.5
10	No fertilizer	1160	1540	2760	500	860	2420	840	1600	1460.0
11	600 fish scrap	820	1620	2440	640	820	2220	1040	1520	1390.0
12	800 cottonseed meal	720	1560	1480	740	1060	1720	1200	1760	1280.0
13	600 4-8-4 fertilizer	820	1240	1500	580	1200	1480	1320	1180	1165.0

Reference: Virginia Agricultural Experiment Station Bulletin 229, "Experiments with Cotton and Peanuts," pages 14 and 15, table 4, Blacksburg, Virginia, October 1922.

The Effect of Fertilizer on Yield of Spanish Peanuts

Conducted by: Florida Agricultural Experiment Station.

Conducted at: The farm of C. W. Williams, north of Marianna, Florida.

Period: 1931.

Purpose: To determine the effect of various fertilizers on yield of peanuts.

Soil: Norfolk sandy loam.

Procedure and Conditions: There were five treatments in the experiment and each was replicated seven times, using 1/10 acre plots. The treatments, the yield of nuts and hay from the various treatments and the grade of the nuts reported by officials of the Alabama-Florida Cooperative Peanut Association are given below.

Results:

FERTILIZER EXPERIMENTS WITH SPANISH PEANUTS

Treatment* (N-P-K)	Yield bu. per Acre	Bu. Increase Due to Fertilizers	Grade U. S. Standard	Acre Yields Hay Pounds	Increase Due to Fertilizers Pounds
No fertilizer	31.3	......	No. 1	945	......
3-10-0	38.3	7.0	No. 1	1,032	87
3-10-4	40.8	9.5	No. 1	1,181	236
3-10-8	40.2	8.9	No. 1	1,224	279
3-10-12	39.5	8.2	No. 2	1,271	326

*Fertilizer used at the rate of 400 pounds per acre.

Reference: Florida Agricultural Experiment Station 1932, Annual Report, pages 28 and 29, table 3, Gainesville, Florida, June 30, 1932.

Rates on Fertilizer (NPK) Application and Lime Test

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1931-1937.

Purpose: To determine the best rate of fertilizer to apply to peanuts.

Soil: Tifton sandy loam.

Procedure and Conditions: In this test peanuts followed a general rotation in which other crops received 200 to 600 pounds of complete fertilizer. The rates-of-application test was divided into 3 parts, one receiving no limestone, one 500 pounds of limestone and another receiving 1,000 pounds of limestone. Lime has not given profitable returns on well drained Tifton sandy loam soils.

Results:

RATES ON FERTILIZER (NPK) APPLICATION AND LIME TEST

Yield of Unhulled Nuts in Pounds Per Acre

Year	No Fertilizer	200 Lbs. 2-10-4	400 Lbs. 2-10-4	600 Lbs. 2-10-4	800 Lbs. 2-10-4
	No Limestone				
1931	1340	1310	1300	1370	1340
1932	1436	1556	1615	1692	1671
1933	1510	1680	1805	1710	1505
1934	1444	1506	1473	1475	1403
1935	640	702	761	916	954
1936	1195	1250	1343	1331	1295
1937	1260	1440	1560	1710	1730
Average Yield	1361	1349	1408	1458	1414
	500 Lbs. Limestone				
1931	1080	1180	1320	1200	1200
1932	1396	1528	1568	1704	1730
1933	1470	1600	1660	1610	1690
1934	1352	1292	1408	1418	1490
1935	770	930	1104	1160	1100
1936	1070	1160	1164	1220	1260
1937	1480	1660	1756	1840	1902
Average Yield	1230	1336	1426	1450	1482
	1000 Lbs. Limestone				
1931	990	1000	1140	1160	1180
1932	1436	1594	1774	1796	1832
1933	1460	1470	1650	1680	1490
1934	1482	1492	1546	1542	1592
1935	794	928	1040	1118	1086
1936	1046	1170	1155	1222	1246
1937	1330	1520	1624	1820	1800
Average Yield	1220	1310	1418	1477	1461

Reference: Georgia Coastal Plain Experiment Station Eighteenth Annual Report, 1937-1938, page 27, table 15, July 1938, Tifton, Georgia.

Yield Peanuts from Soil Types Receiving Different Fertilizers—1938-39

Conducted by: North Carolina Agricultural Experiment Station.

Conducted at: Edgecombe and Bertie Counties, North Carolina.

Period: 1938-1939.

Purpose: To determine the value of different complete fertilizers and fertilizer materials in increasing peanut yields on different soil types.

Soil: Norfolk very fine sandy loam and Ruston loam soil.

Procedure and Conditions: The tests were conducted on several selected farms in each county using different fertilizer treatments, each treatment being replicated six times in the same field. The fertilizer was applied at planting time in the row. The supplement treatment which included lime and gypsum was applied (1) Dolomitic lime applied in the row at planting time and (2) gypsum applied on the foliage at blooming time.

Results:

YIELD PEANUTS FROM SOIL TYPES RECEIVING DIFFERENT FERTILIZERS

Rate	Fertilizer	Supplement		Norfolk very fine sandy loam Edgecombe Co. Yield Lbs.		Ruston loam soil Bertie County Yield Lbs.	
	Treatment	Rate	Treatment	1938	1939	1938	1939
25	Muriate of potash			1610.4	1540.0	598.4	1284.8
75	Muriate of potash			1522.4	1540.0	677.6	1557.6
200	0-12-6			1284.8	1742.4	563.2	1460.8
200	3-12-6			1434.4	1452.0	704.0	1425.6
450	Superphosphate			1284.8	1425.6	440.0	1443.2
200	0-12-6	400	Lime[1]	1381.6	1821.6	704.0	1416.8
200	0-12-6	400	Gypsum[2]	1557.6	1460.8	704.0	1548.8
		400	Lime[1]	1267.2	1786.4	554.4	1460.8
		400	Gypsum[2]	1293.6	1566.4	668.8	1302.4
		400	Lime[1])				
		400	Gypsum[2])	1267.6	1768.8	651.2	1504.8
Average yield of check plot				1170.4	1592.8	598.4	1408.0

Reference: North Carolina Agricultural Experiment Station Agronomy Information Circular 123, "Soil Fertility Investigations with Peanuts," January 1940, Raleigh, North Carolina.

Peanut Yields on Soil Types Receiving Different Fertilizer Treatments

Conducted by: North Carolina Agricultural Experiment Station.

Conducted at: Bladen, Martin, Perquimans and Hertford Counties, North Carolina.

Period: 1939.

Purpose: To determine the value of different complete fertilizers and fertilizer materials in increasing peanut yields on different soil types.

Soil: Ruston sandy loam, Portsmouth sandy loam. Norfolk sandy loam and Coxville very fine sandy loam.

Procedure and Conditions: Several farms were selected in the following counties: Bladen, Martin, Perquimans and Hertford, on which to conduct fertilizer experiments with peanuts. The pH reading was taken on each field used in these tests.

The fertilizer treatment used in these tests was as follows: (1) No fertilizer with gypsum in the row and on the foliage, (2) muriate of potash 25 pounds per acre with no gypsum, 300 pounds in the row and 300 pounds on foliage, (3) superphosphate with no gypsum, 300 pounds gypsum in the row and 300 pounds on the foliage, (4) 0-12-6 with no gypsum, 300 pounds gypsum in row and 300 pounds on foliage, and (5) 3-12-6 with no gypsum, 300 pounds gypsum in row and 300 pounds on foliage.

Results:

PEANUT YIELDS ON SOIL TYPES RECEIVING DIFFERENT FERTILIZER TREATMENTS

Plot No.	Fertilizer		Gypsum		Yield Per Acre			
	Rate	Treatment	Rate	Application pH	Ruston sandy loam Bladen County 4.5-5.2 Lbs.	Portsmouth sandy loam Martin County 4.4-5.5 Lbs.	Norfolk sandy loam Perquimans County 5.0-5.8 Lbs.	Coxville very fine sandy loam Hertford County 5.4-6.5 Lbs.
1		None	......	....	572.0	880.0	2129.6	1126.4
2		None	300	In row	440.0	1180.0	2120.8	1240.8
3		None	300	On fol.	1293.6	739.2	2279.2	1117.6
4	25	Mur. of Pot.	......	....	1311.2	1258.4	1865.6	1214.4
5	25	Mur. of Pot.	300	In row	1003.2	1201.6	1592.8	1328.8
6	25	Mur. of Pot.	300	On fol.	1452.0	1188.0	1997.6	1390.4
7	150	Superphos.	......	....	950.4	1188.0	2455.2	869.4
8	150	Superphos.	300	In row	1408.0	906.4	2120.8	1047.2
9	150	Superphos.	300	On fol.	976.8	1117.6	1900.8	1434.4
10	200	0-12-6	......	....	924.0	1452.0	2244.0	1196.8
11	200	0-12-6	300	In row	1320.0	1003.2	2261.6	1223.2
12	200	0-12-6	300	On fol.	1592.8	1126.4	2156.0	1020.8
13	200	3-12-6	......	....	976.8	871.2	2464.0	1399.2
14	200	3-12-6	300	In row	1311.2	1161.6	2252.8	968.0
15	200	3-12-6	300	On fol.	1180.8	1619.2	2499.2	1496.0

Reference: North Carolina Agricultural Experiment Station Agronomy Information Circular 123, "Soil Fertility Investigations with Peanuts," January 1940, Raleigh, North Carolina.

Effects of Various Forms of Lime on Yield of Peanuts

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Holland, Virginia.

Period: 8 years—1914-1921.

Purpose: To determine the effect of various forms of lime fertilizer on yield of peanuts.

Procedure and Conditions: Results obtained from the use of lime under peanuts seem to indicate that the quality is affected much more than the quantity. This is evidenced by a whiter, firmer hull and an increase in weight per bushel.

Ground shells when used at the rate of 2 tons per acre gave practically the same results as one ton of burnt shells, while 4 tons of ground shells did not do so well as 2 tons of burnt shells. Contrary to expectations the heavy application of ground shells produced a much more harmful effect than half the amount of burnt shells. Plots receiving 4 tons of ground shells seem ruined for a time at least for growing any crop. This condition was much more evident after the second application four years from the time the first application was made.

The yield where land plaster was used was as good as that on the lime plots and the quality probably averaged a little better. However, crimson clover does not do well on the plot to which land plaster was applied.

The yield on plots receiving acid phosphate, bonemeal and basic slag was good, but the quality of peanuts from the acid phosphate plot was better than that of the other two.

Plots receiving nitrate of soda and potash in addition to lime produced a large number of dark-hulled nuts so late in maturing that they could not be harvested along with the other plots and the vines were killed by frost before maturity, causing the production of a large percent of immature peanuts of poor quality.

Results:

THE EFFECTS OF LIME ON THE YIELD OF PEANUTS

Plot No.	Materials Used in Pounds per Acre	Yield in Pounds of Peanuts Per Acre								Av. Yield 1914-1921
		1914	1915	1916	1917	1918	1919	1920	1921	
1	2000 burnt shells	1600	1260	2000	700	800	1100	1480	1620	1320.00
2	4000 ground shells	1440	1300	2240	720	1280	1020	500	1440	1242.50
3	500 land plaster	1400	1180	1600	640	1560	1240	1060	1720	1300.00
4	No lime	900	760	1500	600	1360	1380	900	1400	1100.00
5	4000 burnt shells	1700	1300	1900	640	1200	960	680	1280	1207.50
6	8000 ground shells	1200	840	1620	400	840	620	280	620	802.50
7	500 basic slag	1460	940	2200	760	1280	1660	900	1920	1390.00
8	500 acid phosphate	900	1260	1400	720	1380	1750	960	1900	1283.75
9	500 bone meal	2000	980	1900	620	1000	1480	1000	1940	1365.00
10	No lime	1800	900	1620	460	800	1720	780	2400	1310.00
11	(2000 burnt shells (200 nitrate of soda	3200	1160	1680	820	920	1920	1020	2440	1650.00
12	(2000 burnt shells (200 muriate of potash	800	1020	1460	760	1000	1720	1200	2200	1270.00
13	(2000 burnt shells (200 sulphate of potash	1100	1080	1340	600	1060	1200	1240	1540	1145.00

Reference: Virginia Agricultural Experiment Station Bulletin 229, "Experiments with Cotton and Peanuts," pages 15 and 16, table 5, Blacksburg, Virginia, October 1922.

The Effects of Ground Oyster Shells Applied at Intervals of 3 Years on Yield of Cotton, Peanuts, Corn, Soybean Hay and Irish Potatoes

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Holland in Nansemond County, Virginia.

Period: 1923-31.

Purpose: To determine the most economical rates of liming for the more important crops grown in the section.

Soil: Onslow fine sandy loam. The top soil is dark gray sandy loam and the subsoil is a pale yellow sandy loam slightly heavier than the surface layer. The land is nearly flat and ditches are depended upon to carry off the surface water. In wet weather the soil water rises to within a few inches of the surface. This type of soil is not so well adapted to the growing of peanuts of as good quality as is Norfolk sandy loam.

Procedure and Conditions: A five-year rotation of cotton, corn, peanuts, soybeans and Irish potatoes was established. The land was kept covered with a growing crop at all times. Cotton was followed by a cover crop of crimson clover, corn by wheat, peanuts by vetch, soybeans by rye, and potatoes by soybeans, which were plowed down in the fall and followed by oats as a winter cover crop. Nothing was removed from the land except the main crops of the rotation, namely, cotton, peanuts, corn, soybean hay and potatoes. All cover crops were turned under immediately preceding the planting of the next crop in the rotation, thus maintaining an abundance of organic matter in the soil. The corn was fertilized with 500 pounds of 4-12-4, the cotton with 600 pounds of 4-12-6 and the potatoes with 1,000 pounds of 7-6-5 fertilizer to the acre. Other crops in the rotation received no fertilizer.

The area used in this rotation was subdivided into eight plots which were treated as indicated below. Plot 1 received no lime and plots 2 to 8, inclusive, received the quantities of lime stated in the table in the form of ground oyster shells. The lime was applied by broadcasting every third year and it was worked into the soil while preparing the seedbed for the next crop.

Results:

THE EFFECTS OF GROUND OYSTER SHELLS APPLIED AT INTERVALS OF THREE YEARS ON THE YIELD OF COTTON, PEANUTS, CORN, SOYBEAN HAY AND IRISH POTATOES

Plot No.	Amount of lime applied per acre	Yield of seed cotton per acre 9-Yr. Av. 1923-1931	Yield of unshelled peanuts per acre 9-Yr. Av. 1923-1931	Yield of corn per acre 9-Yr. Av. 1923-1931	Yield of field cured soybean per acre 5-Yr. Av. 1926-1930	Yield of I. potatoes per acre 7-Yr. Av. 1925-1931
	Pounds	Pounds	Pounds	Bushels	Pounds	Bushels
1	No lime	950	1100	52.2	5150	85.5
2	600	1000	1250	53.6	5300	87.5
3	900	1050	1350	55.7	5850	94.2
4	1200	1050	1300	59.3	5800	92.5
5	1500	1100	1350	60.0	6050	100.8
6	1800	1050	1450	63.6	5950	102.5
7	2100	1100	1300	58.6	5950	103.3
8	2400	1100	1200	56.4	6000	97.5

Reference: Virginia Agricultural Experiment Station Bulletin 284, "Experiments with Lime, Fertilizers and Varieties of Field Crops in the Cotton and Peanut Section of Virginia," pages 3 and 4, table 1, Blacksburg, Virginia, May 1932.

Comparison of Ground Oyster Shells and Dolomitic Limestone as Sources of Lime

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Holland, in Nosemond County, Virginia.

Period: 1926-1931.

Purpose: To compare ground oyster shells and dolomitic limestone as sources of lime.

Soil: Onslow fine sandy loam. The top soil is dark gray sandy loam and the subsoil is a pale yellow sandy loam slightly heavier than the surface layer. The land is nearly flat and ditches are depended upon to carry off the surface water. In wet weather the soil water rises to within a few inches of the surface. This type of soil is not so well adapted to the growing of peanuts of as good quality as is Norfolk sandy loam.

Procedure and Conditions: A rotation was established consisting of cotton, corn and peanuts with Abruzzi rye following corn and crimson clover following cotton as cover and green manure crops. The corn received an annual application of 400 pounds of 2-8-4 fertilizer to the acre at planting time and 150 pounds of nitrate of soda to the acre as side dressings. The cotton received 600 pounds of 4-8-6 fertilizer at planting time. The peanut crop was not fertilized. The area was subdivided into five plots and lime was applied as indicated in the table. The ground oyster shell used in this test contained approximately 90 per cent of calcium carbonate and the dolomitic limestone contained approximately 50 per cent of calcium carbonate and 40 per cent of magnesium carbonate. The first application of lime was made at the beginning of the experiment in 1926 and the second application in 1930.

Results:

A COMPARISON OF THE EFFECT OF GROUND OYSTER SHELLS AND DOLOMITIC LIMESTONE AND THE YIELDS OF COTTON, CORN AND PEANUTS, SIX-YEAR AVERAGE, 1926-1931

Plot No.	Rate of Application Per Acre	Seed Cotton		Corn		Uns'd P'nuts		Total Val. Per A. 6-Yr. Av.
		Yield Per Acre	Value	Yield Per Acre	Value	Yield Per Acre	Value	
		Lbs.	Dol.	Lbs.	Dol.	Lbs.	Dol.	Dol.
1	1 ton ground oyster shells	975	39.00	41.5	31.13	1185	47.40	235.06
2	1 ton dolomitic lomestone	885	35.40	43.1	32.33	1185	47.40	230.26
3	No lime	825	33.00	41.8	31.35	1020	40.80	210.30
4	2 tons ground oyster shells	855	34.20	48.2	36.15	960	38.40	217.50
5	2 tons dolomitic limestone	840	33.60	47.5	35.63	930	37.20	214.86

Corn was valued at 75c a bushel and cotton and peanuts at 4 cents a pound. Ground oyster shells delivered at Holland cost approximately $6.00 a ton and dolomitic limestone $3.00 a ton. Therefore, the cost of oyster shells per acre per year was $1.50 and the cost of dolomitic limestone 75c per acre per year where the 1-ton applications were used and twice these amounts where the 2-ton applications were used.

Reference: Virginia Agricultural Experiment Station Bulletin 284, "Experiment with Lime, Fertilizers and Varieties of Field Crops in the Cotton and Peanut Section of Virginia," pages 6 and 7, table 3, Blacksburg, Virginia, May 1932.

Planting

As stated under land preparation, most of the peanut growers of Southeast Alabama bed their peanut land with a middle buster about two weeks before planting.

When they are ready to plant, if fertilizer is used, a straight shovel is used on the distributor to open the bed. They try to get the furrow open to a level of the middle buster furrow. If the distributor is not used, a straight shovel on a Georgia stock is used to open the furrow. This method is always used with the runner varieties. Sometimes with the Spanish peanuts the land is only flat broken and is layed off with the fertilizer distributor, or with the Georgia stock using a short straight shovel. The peanuts are planted with a planter, mostly Cole planters, in this furrow.

The usual spacing practice for runner varieties of peanuts is 30″ to 36″ rows spaced from 8″ to 14″ in the drill. To plant with this spacing from 17 to 25 pounds of shelled peanuts are required per acre. Spanish peanuts are planted in 24″ to 30″ rows and spaced from 6″ to 10″ in the drill, requiring 25 pounds to 30 pounds peanuts per acre.

Their peanuts are planted immediately following cotton which is usually from the 1st to 15th of April. The weather should be warm and settled before planting peanuts. By planting this way there seems to be very little conflict in cultivating the two crops.

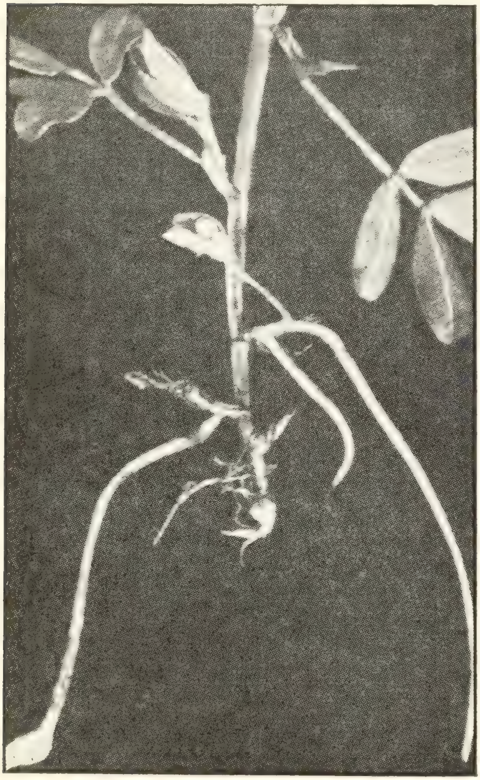

Figure 2—Peanut flower and the pegs that form pods.

When Spanish peanuts are planted in 24 inch rows, the vines of one row will lean against the vines of the next row, thus shading the middles and helping to control the grass. Peanut plants produce many blooms. These blooms are borne at the joints where the leaves are attached to the stems and as soon as pollination takes place the bloom fades and the peg or stem elongates and goes into the ground where the pod develops as in figure 2. The first blooms appear in the end of link near the main stalk as illustrated in figure 3. The peanuts on the stems or pegs that form on the limbs or vines near the main stalk have been forming a long time before the vine is old enough to put out these stems. When the peanuts are mature they must be dug. Spanish peanuts will sprout if left in the ground too long aftter they have matured. Hence, if the vines are in wide rows they cannot hold each other up but lie down on the ground as illustrated in figure 4.

This gives the pegs a chance to go into the ground. But they have not time to make anything but an empty shell, called a pop. Part of the strength of the vine has been used to make these pops, which have no value. If this wasted plant food had gone to the peanuts first formed, there would have been more kernels and heavier ones. The peanut grower should be interested in getting the largest number of peanuts matured at the same time, especially if they are to be harvested for sale.

There are many living bacteria in the ground that are necessary to plant life. Some of these are easily killed by heat. Close rows that shade the middles to keep the ground cool. This enables a great many bacteria to live and do their work whereas they might die if exposed to the sunheated earth between wide rows.

Every farmer should experiment with his peanuts. Try some in different width rows and watch the results. The close rows will require more careful work.

It seems certain that close rows make more peanuts. At the same time they will require more work. Hence the 24 inch rows seem to be the width that will produce the most peanuts without making the work too inconvenient.

In some instances where peanuts are produced for hogs it is desirable for the vines of the plant to contact the ground to give the pegs on the vines a chance to develop nuts, as it is not necessary for as many nuts to mature at the same time. In some instances with the runner varieties a light roller is run over the vines after the final cultivation to flatten the vines on the ground to enable the pegs to reach the ground in order that nuts may be formed.

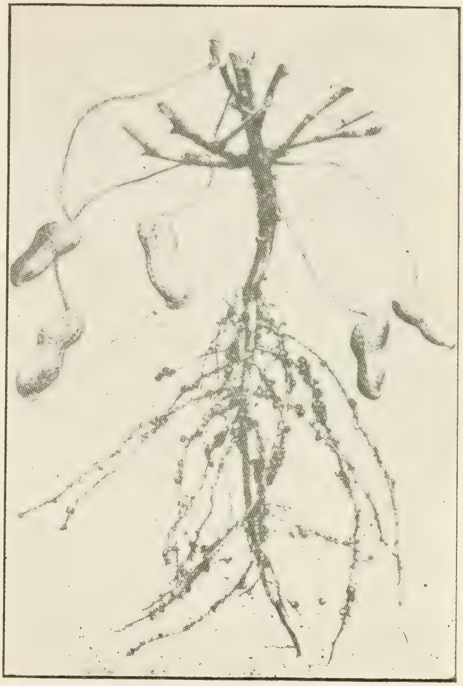

Figure 3—Peanuts forming on limbs near surface of ground.

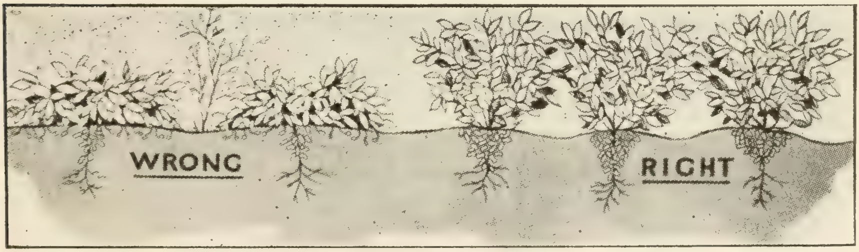

Figure 4—Close rows shade middles and kill the grass. Upright vines make peanut kernels and not pops.

Effect of Spacing on Yield

Conducted by Alabama Agricultural Experiment Station.

18 inch rows, with seed 4 inches in the drill produced 59.5 bushels per acre
24 inch rows, with seed 4 inches in the drill produced 52.7 bushels per acre
30 inch rows, with seed 4 inches in the drill produced 43.6 bushels per acre
36 inch rows, with seed 4 inches in the drill produced 43.3 bushels per acre

18 inch rows, with seed 8 inches in the drill produced 44.1 bushels per acre
24 inch rows, with seed 8 inches in the drill produced 39.0 bushels per acre
30 inch rows, with seed 8 inches in the drill produced 38.2 bushels per acre
36 inch rows, with seed 8 inches in the drill produced 27.1 bushels per acre

18 inch rows, with seed 12 inches in the drill produced 47.9 bushels per acre
24 inch rows, with seed 12 inches in the drill produced 38.6 bushels per acre
30 inch rows, with seed 12 inches in the drill produced 33.4 bushels per acre

References: Tom Huston Peanut Company Bulletin, "Peanuts, Culture and Marketing of the White Spanish Variety in the Southeastern States," pages 10 and 11, Second Edition 1931, Columbus, Georgia.

Virginia Agricultural Experiment Station Bulletin 217, "Peanut Culture," page 8, Blacksburg, Virginia, January 1918.

Farmers surveyed in Southeast Alabama.

Spacing Test with Peanuts in Texas

Conducted by: Texas Agricultural Experiment Station.

Conducted at: Angleton Station, Angleton, Texas.

Period: 1915-1922.

Purpose: To find the spacing that would give the largest yields.

Soil: A light colored phase of Lake Charles clay and clay loam soils. The Lake Charles soils are black to dark-gray in color and range from clay to fine sandy loam in texture although the clay is the most extensive type. These soils have dark-gray, heavy clay subsoils.

Procedure and Conditions: The peanuts in these experiments were planted in three-foot rows. During the period of the experiment the size of the plots ranged from 1/44 to 1/11 of an acre.

In these studies the peanuts followed corn in the four-year rotation of corn, cotton, corn and peanuts. During the last six years, however, grain sorghum occasionally replaced the corn in the rotation. After harvesting, the stalks of cotton, corn, and the grain sorghum usually were plowed under in the fall or winter as conditions permitted. The entire peanut crop, including vines and nuts, was removed from the land in harvesting.

Generally the peanuts were planted flat on land that had been plowed the preceding fall or winter. In some years, however, low beds were formed on the plowed land with a cultivator and the peanuts planted on these beds. Prior to 1920 the seed was dropped by hand but since that time the seed has been planted with a duplex hopper attachment on a lister planter. In the spacing tests the peanuts were dropped by hand.

As a rule, the small-podded varieties were not shelled before planting but the pods were broken crosswise so that a single kernel was dropped in each hill. The large-podded varieties, however, were shelled because the kernels usually do not fill the pod and have a tendency to drop out if the pods are broken, so that an empty hull would not be planted instead of a kernel.

peanuts were planted the latter part of April or first part of May.

Occasionally it was necessary to replant the peanuts because of thin stands resulting from low germination of seed, from unfavorable weather conditions immediately after planting, or from damage caused by rodents. Further, the final stands obtained were poor in most years.

The peanuts were given about the same cultivation as cotton. Shallow clean cultivation was practiced. From three to five cultivations were given during the growing season. As a rule the peanuts were hoed twice and occasionally three times, which was one more hoeing than was given cotton.

The peanuts were dug with a walking mouldboard plow. As a rule the row was barred off and then the center strip containing the plants was turned over. The vines were then shaken out of the soil with a pitchfork and all of the plants on each plot, consisting of two or three rows, were heaped together for drying. Two or three days' drying in the field was generally sufficient to cure the vines and nuts for stacking in the hay mow. When the vines did not dry out rapidly enough, they were turned once.

The Spanish variety was used. The nuts were dropped by hand at specified distances in three-foot rows. In most cases full stands were not obtained on account of poor germination and injury from rodents. The final stands, however, were obtained by an actual count of the plants at harvest time.

Miscellaneous: The average yearly rainfall at Texas Substation No. 3, located at Angleton in the Gulf Coast Prairie, approximately 18 miles from the Gulf of Mexico, was 44.53 inches for the 19 years, 1915-1933. While the monthly and yearly rainfall is ample, the distribution often varies widely in individual months and years.

The temperature during the growing season is favorable to the growth of peanuts. The mean maximum temperature ranged from 78.4° F. in April to 92.2° F. in August. The mean maximum temperature ranged from 57.8° F. in April to 71.9° in July.

Results:

YIELD PER ACRE IN POUNDS OF SPANISH PEANUTS WITH DIFFERENT SPACINGS OF PLANTS IN THREE-FOOT ROWS

Spacing of Plants in Row Inches	1915	1916	1917	1918	1920	1921	1922	Average 1916-1918
3			2181	807				
6		5244	2061	957				2754
9	2427	4605	2034	771				2470
12		4776	2007	696	1440			2493
15					939	672		
18	2235	4521	1815	783	945	564	1725	2373
21					1317	273	1554	
24		3477	1509	534	729			1840
27	1968				777	288	2088	
30						279	1710	
36	1083	2856				204	1194	
48							846	

Reference: Texas Agricultural Experiment Station Bulletin 503, "Peanut Growing in the Gulf Coast Prairie of Texas," pages 6, 7, 8, 9, 13, and 14, table 7, College Station, Texas, January 1935.

The Effect of Width of Rows Upon Yield of Peanuts

Conducted by: Texas Agricultural Experiment Station.

Conducted at: Substation No. 11, Nacogdoches, Texas.

Period: 1914-1916.

Purpose: To determine the effect of the width of the row upon the yield of nuts and forage.

Procedure and Conditions: The plantings were made each year in March and normal stands of plants secured in April. The yields in 1916 were reduced on account of damage of moles. Eighteen and thirty-six inch rows were compared.

Results:

ANNUAL AND AVERAGE ACRE YIELDS IN BUSHELS OF NUTS AND TONS OF FORAGE IN 18- and 36-INCH ROWS IN TEXAS

Inches Between Rows	1914		1915		1916		Av. 1914-1916	
	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage
36	36.3	.44	34.6	.80	19.3	.53	30.0	.59
18	36.0	.50	37.0	.77	23.0	.35	32.0	.54

Reference: Texas Agricultural Experiment Station Bulletin 381, "Peanuts in Texas," pages 12 and 13, table 5, May 1928, College Station, Texas.

The Effect of Rate of Planting on Yield of Peanuts

Conducted by: Texas Agricultural Experiment Station.

Conducted at: Substation No. 1, Beeville, Texas.
Substation No. 8, Lubbock, Texas.

Period: Beeville—1918-1924.
Lubbock—1919-1925.

Purpose: To determine the effect the rate of planting has on yield.

Procedure and Conditions: The distance between plants in the row depends upon the variety of peanuts planted, fertility of the soil, and amount of rainfall. Experiments conducted with the Spanish variety at Substation No. 1, Beeville, and Substation No. 8, Lubbock covering a period of five and seven years, indicate that close planting will produce higher yields of both nuts and forage than wide spacing.

Results:

YIELD PER ACRE IN BUSHELS* OF NUTS AND TONS OF FORAGE AT DIFFERENT PLANTING RATES. BEEVILLE, TEXAS

Inches Between Plants	1918		1920		1922		1923		1924	
	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage
3					37.6	.71		1.76		
6	17.0	1.22						1.41		
9			35.4	1.06	35.7	.64		1.84		
12	15.7	1.04			81.6	1.39		1.01		
15			32.7	.83	89.4	1.37		.83		
18	14.9	.83	27.2	.61	83.6	1.05				.65
21										
24	13.5	.43	26.8	.57						.47
30	13.9	.66		.30						.39
36	13.6	.68								.31

*Yield of nuts in this Bulletin are calculated at 30 pounds per bushel for Spanish and Macspan and 22 pounds for other varieties.

YIELD PER ACRE IN BUSHELS OF NUTS AND TONS OF FORAGE AT DIFFERENT PLANT RATES—LUBBOCK, TEXAS

Inches Between Plants	1919		1920		1921		1922		1923		1925		6-Yr. Av.	
	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	Forage	Nuts	age For-
6	94.7	1.72	47.6	1.77	60.4	2.28	15.2	1.60	45.1	2.64	35.0	.68	49.6	1.78
9	84.4	1.52	45.6	1.55	51.1	1.74	16.6	1.44	40.2	2.84	35.0	.63	45.4	1.62
12	72.1	1.26	39.7	1.48	47.9	1.65	17.1	1.24	43.2	2.90	32.5	.60	42.0	1.51
15	61.8	1.25	31.1	.99	45.4	1.49	20.1	1.66	41.7	1.84	33.7	.49	39.8	1.20
18	53.5	1.06	32.7	1.14	31.6	1.10	15.7	.81	39.7	2.72	37.5	.72	35.1	1.34

Reference: Texas Agricultural Experiment Station Bulletin 381, "Peanuts in Texas," pages 11 and 12, tables 3 and 4, May 1928, College Station, Texas.

Cultivation

Lack of cultivation causes as many crop failures with peanuts as any other thing. It is a crop that must be kept as nearly free from grass as possible.

A test conducted at the Wire Grass Substation, Headland, Alabama, shows the following results:

Peanurts planted: April 20
Norfolk sandy loam soil
No fertilizer used on any plot

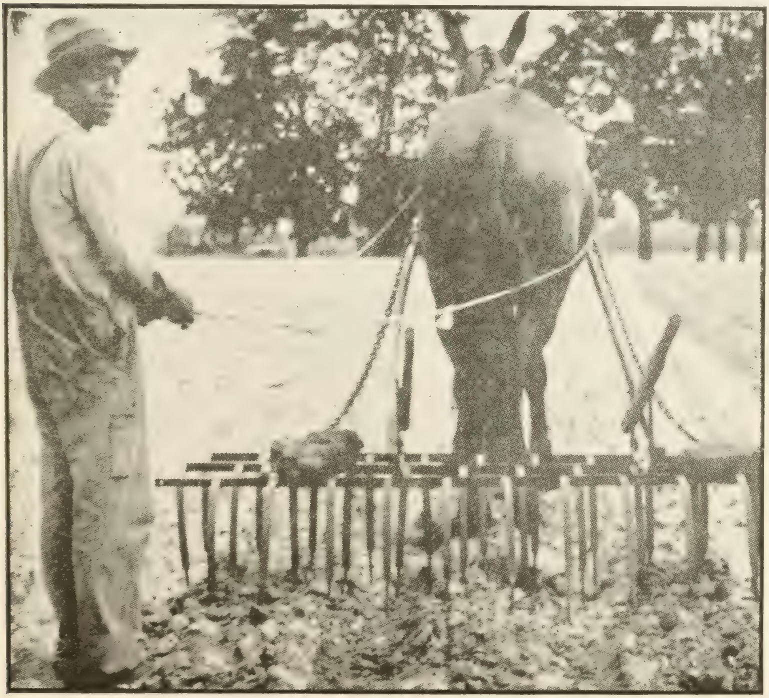

Figure 5—Cultivating with weeder.

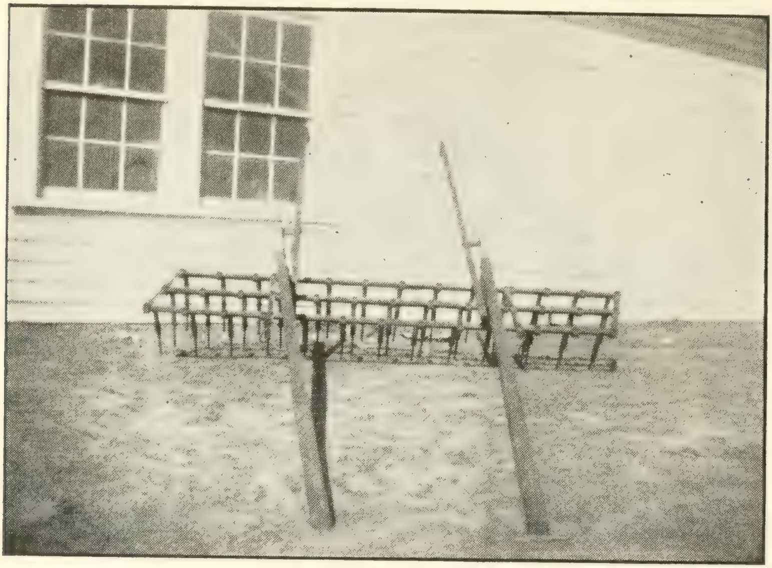

Figure 6—Showing detail of weeder.

	1939—Peanuts Per Acre
Check plot, clean cultivation, no grass	1150
Little grass	900
Considerable grass	600

The cultivation should begin, according to a summary of the farmers surveyed and the Virginia experiment station, not later than the time the peanuts begin to come through the ground. This cultivation may be given with a weeder, or joe harrow, commonly known as top harrow. Figures 5 and 6 illustrate the weeder and its use in peanut cultivation. In most cases where the joe harrow is used one mule is used to pull two harrows. This allows the mule to walk in the middle and does not destroy any peanuts. This cultivation breaks the crust, if any has formed, and destroys the young grass or weeds which may have started to grow. The thought might arise that this cultivation will destroy the peanuts, but it does not because of the way the peanuts are planted. The beds being opened with a straight shovel and the peanuts planted in this furrow, puts them low enough that the weeder or joe harrow only scratches the sides of the furrow and pushes enough dirt in the furrow to cover the small grass or weeds. The critical stage in the cultivation of the peanut crop is when the plants are very young. It is much easier to cultivate the crop when the plants are young than later. At this stage it is possible to cover the young plants almost completely without interfering in the least with their growth, while at the same time the grass is smothered.

In many cases the weeder or joe harrow is used to give up to three cultivations, at four to six day intervals, beginning when the plants first begin to peg through the ground. Cultivating in this way the grass is kept under control and the beds are worked down giving practically a level surface which is very desirable.

After cultivation with the weeder or joe harrow, there are many different methods of cultivation used. Some use the scrape (sometimes known as the heel sweep) as illustrated in fiuges 7 and 8, with a small lead plow; some bar off real shallow with turning plow and then side with scrape; and

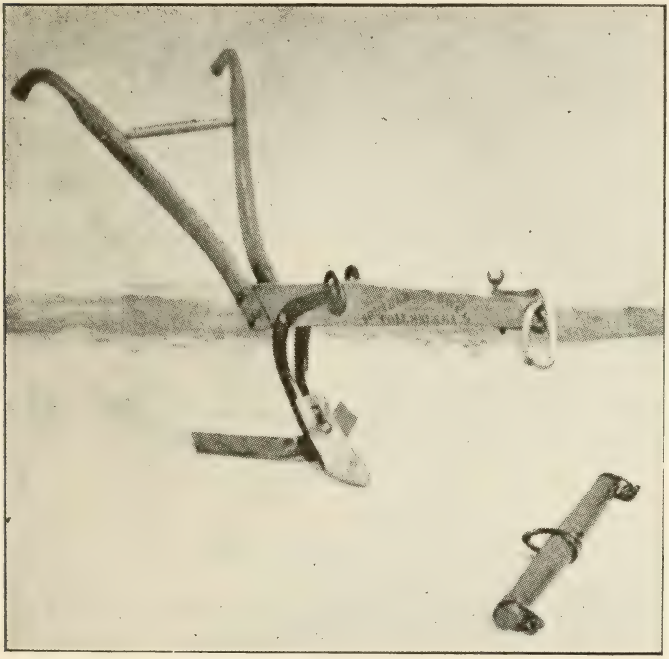

Figure 7—Scrape or heel sweep.

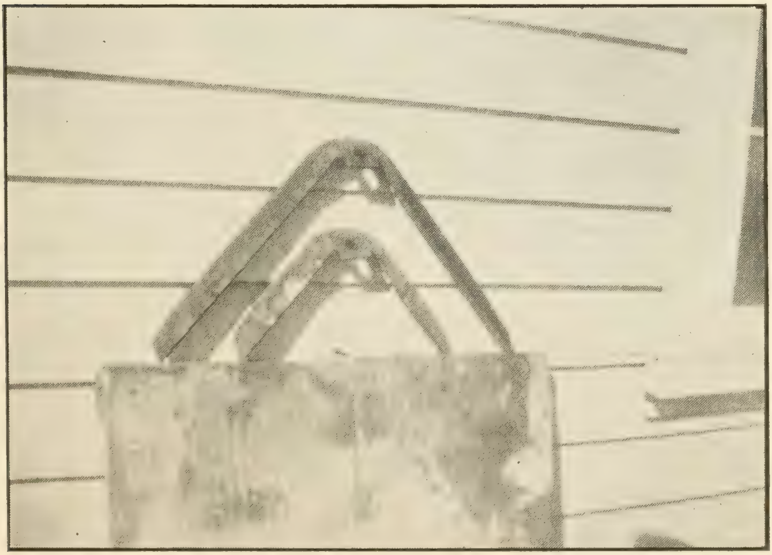

Figure 8—Scrape or heel sweep.

some use the joe harrow with the front teeth removed and turning the big end of the teeth down. If the ground is hard enough weight is put on the joe harrow to make it take the ground well. This cultivation will very likely completely cover many of the peanuts, which makes it necessary to follow this cultivation with the weeder to uncover the plants. It is a very satisfactory cultivation because the peanuts are about freed of grass.

The next cultivation is siding with about a 16" scrape and a small lead plow run shallow and as flat as possible. At this point the peanuts are usually hoed, followed by siding again with scrape or heel sweep. The last cultivation is one furrow in the middle with a 16" or 18" scrape or heel sweep run shallow and flat.

Peanuts cultivated in this way seldom require more than one hoeing. Occasionally after laying by some grass is left, and to get the best production this grass should be pulled out by hand. By having the crop as clean as possible the yield is increased and much labor will be saved in harvesting. Ordinary crab grass is the greatest pest of the peanut grower.

References: Farm surveys in Southeast Alabama. Virginia Agricultural Experiment Station Bulletin 218, "Peanut Culture," page 11, January 1918, Blacksburg, Virginia.

Digging

Peanuts must be dug at the right time to secure the maximum yield of Number one nuts. If gathered too early there will be too many shriveled kernels. If gathered too late, some of them will have sprouted. Especially is this true of bunch type peanuts.

According to information secured in Southeast Alabama and from experiment stations, Spanish peanuts should be dug when not more than one peanut is sprouted per bunch. This requires close examination in order to dig at the right time. When the leaves start to turn brown and fall from the vine they are about ready to dig, and at this point they should be examined every day until the first sprouted peanut is observed, and then they are ready to dig. Runners are ready to dig when upon examination it is found that approximately 65 per cent of the hulls turn dark inside when burst open, also when the stems begin to turn dark. The runners will stay in the field much longer than the Spanish without serious damage to the nuts.

If the grass worms should eat the foliage from the vines late in the season, it is very necessary that the peanuts be dug within two to four days or all the nuts will come off in the ground.

The idea is to gather peanuts when the most Number 1 nuts can be gotten. A few of the bottom peanuts may have sprouted, a few of the top ones may not be grown, but the bulk of the middle peanuts will, if properly matured, be Number 1 nuts.

Some of the farmers in Southeast Alabama use a eight or ten inch turn plow to dig their peanuts. The mould board and regular point is removed, and a regular peanut point replaces the regular point. Some use a turn plow with the mould board removed, shown in figure 9. Some use the champion peanut plow, shown in figure 10. This plow has a longer foot and will not choke nearly so quickly as a regular turn plow.

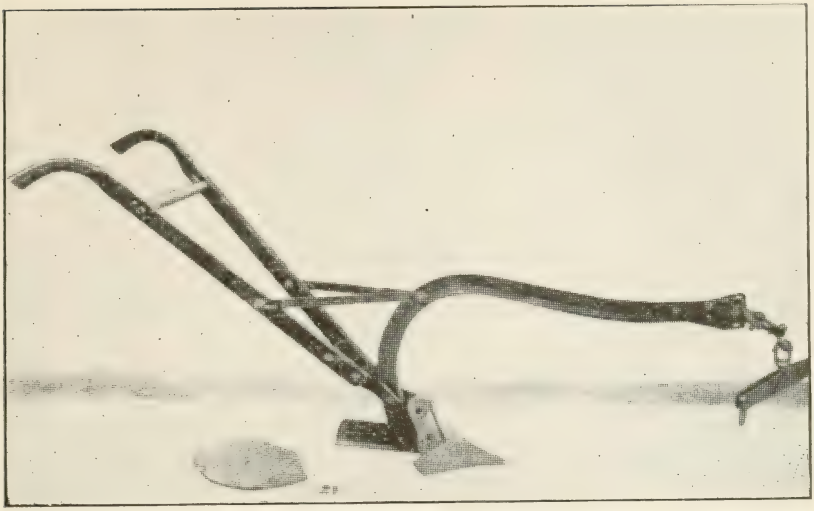

Figure 9—Turning plow used to dig peanuts.

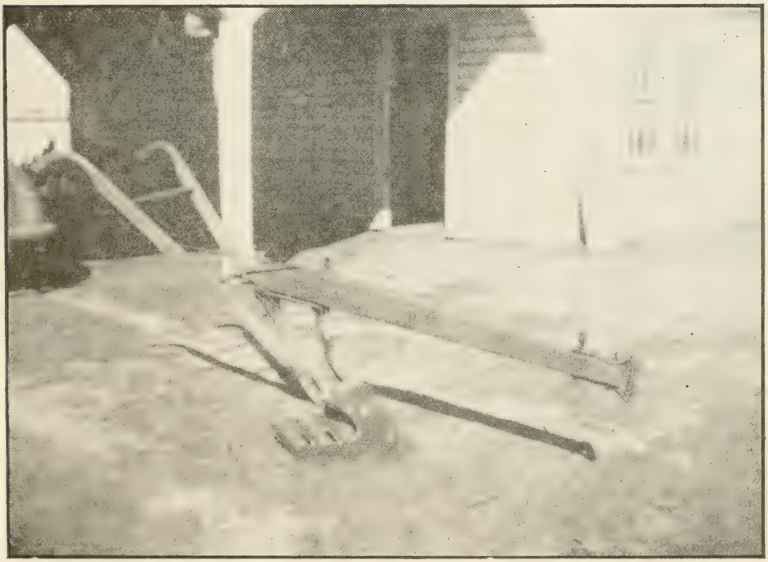

Figure 10—Champion peanut plow used in digging peanuts.

The plow should go into the field sometime before the stackers, usually about two hours. The uprooted vines and peanuts will then have time to dry out some and the dirt will drop off better. Since dampness will cause damage to nuts, peanuts should never be stacked when the vines are damp or when there is wet dirt clinging to the nuts, because it will cause damaged nuts. The foliage should be perfectly dry before stacking.

Do not dig any more in a day than can be stacked that day. If it rains over night the peanuts left on the ground will be damaged.

Stacking

The peanut producer should be interested in producing the best grade peanuts possible, because the better the grade the higher the price received. To do this peanuts must be properly cured, and to cure properly they must be stacked properly.

Before stacking certain preparations must be made. In securing materials for stacking, the peanut growers of Southeast Alabama cut stacking poles 3 inches to 4 inches in diameter and 7½ feet to 9 feet long. From fifteen to twenty-five poles are required per acre, depending on production. The poles are set from fifteen to eighteen inches deep in the ground by digging hole with post hole digger and tamping the dirt around the pole. Two cross pieces 1 inch by 3 inches by 36 inches to 48 inches are required and should be nailed about 18 inches above the ground as illustrated in figure 11 on which to stack the peanuts in order that 'air' may be allowed to circulate under the stack.

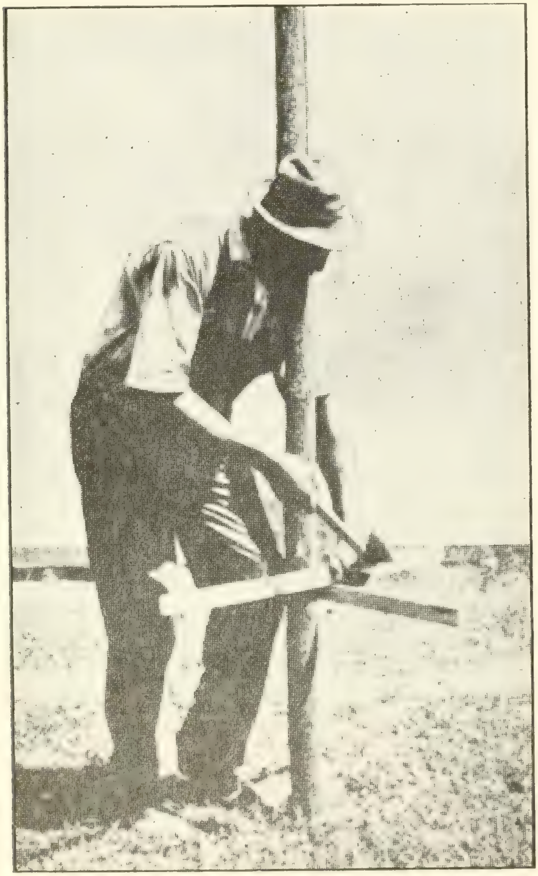

Figure 11—Pole on which peanuts are stacked.

Peanuts should never be stacked in large stacks like stacking hay. The finished stack should be 3 to 5 feet wide and from 6 to 7 feet high. A stack of this size permits air passage and facilitates curing. When peanuts are put in the stack, they contain considerable moisture, which causes some heating if the stacks are too large. Air cannot circulate adequately through large stacks, thus damaged peanuts and hay result.

The peanut growers of Southeast Alabama stack their peanuts with pitchforks and hand. They begin by placing small forks of vines on the tip ends of the cross pieces until the cross pieces are well covered. They continue placing small forks of peanuts on the stack, rotating around the stack until the stack is

6 feet to 7 feet tall and 3 feet to five feet wide. The stack is rounded off at the top and is usually capped with a small amount of grass. No particular care is exercised in placing the nuts and vines in any particular arrangement. They say to stack with the nuts next to the pole is too expensive and that the quality of the nuts will not be affected if the stacks are not too large. Some sources of information recommend stacking with the nuts placed toward the pole and is a very satisfactory method of stacking, but this is not necessary in order to get Number one nuts. In curing the stacks usually settle. As the stacks settle the cap should be pushed down the pole to prevent rain holes from forming in some of the stacks.

In stacking, a row of stack poles is usually placed every 12 to 15 rows of peanuts, shown in figure 12.

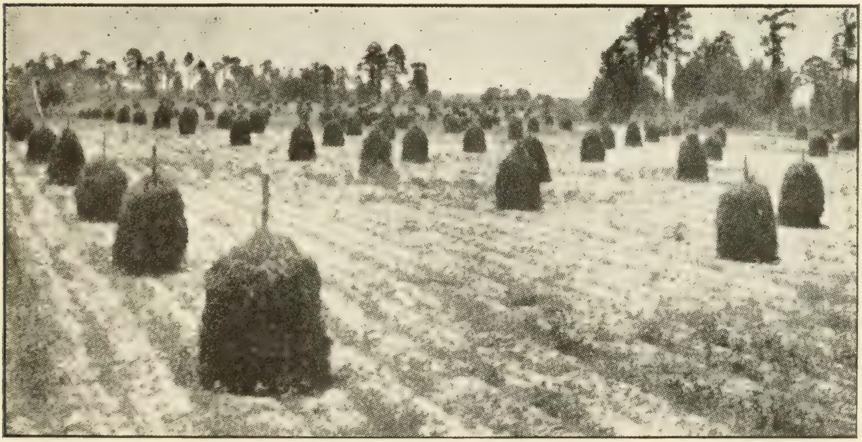

Figure 12—Shows arrangement of stack poles in a peanut field.

Some growers concentrate their stacks in a small area, and fence separate from the field to keep the stock off. When stacked this way it takes longer to cure and usually they will not cure as well, and the stacking is more expensive because it is necessary to haul the peanuts to the stacks.

Picking

Peanuts should stay in the stacks from six to eight weeks before picking, the exact duration of the curing period depending upon the kind of weather. Therefore, when to pick should be judged more by the condition of the peanuts than by the length of time they have been in the stack.

If the weather is warm and dry during the curing season, the peanuts might be ready in four weeks. If it has been cold and damp, ten to twelve weeks may be necessary. Three weeks is about the minimum time for curing.

To determine when the peanuts have cured sufficiently to pick requires close inspection after the third or fourth week. To make this examination pull a few of the peanuts out of different stacks from different parts of the field and strip the nuts from the vines: Shell and eat some of the nuts. When they are ready to pick, the nuts should taste ripe and brittle. If the husk will slip off the kernel easily it is a good sign that they have cured enough to pick.

When the picker arrives it should be set in the proper position with the wind. The wind should blow over the feed end of the machine and on out in the same direction the fan is blowing, as in figure 13. This will keep the trash from blowing back into the peanuts. The wind will help the fan to take the trash and hay in the right direction. If the peanuts are trashy they will grade low.

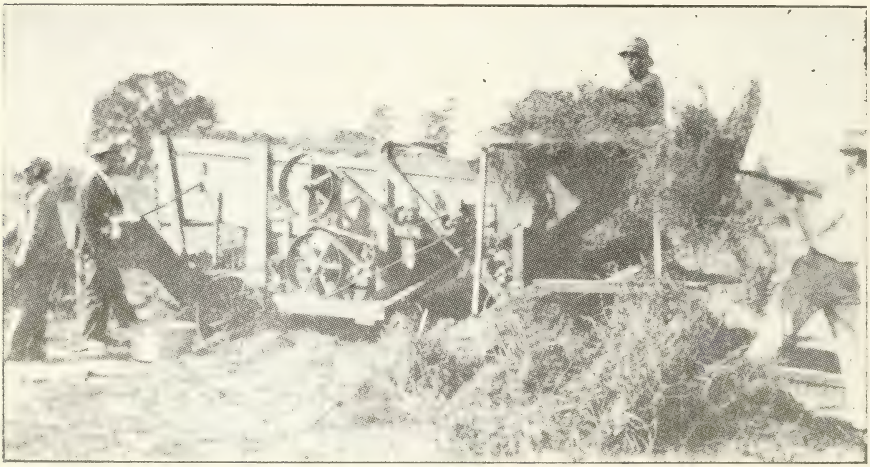

Figure 13

As the peanuts are hauled to the picker, examine each stack very carefully, especially if the curing season has been wet and stormy. Some stacks may be badly damaged throughout. Other stacks may show some damage on the top and bottom of the stack and the middle be all right. The best stacks and the undamaged portions of the partly damaged stacks should be picked together and kept separate.

The damaged stacks and the tops and bottoms of the partly damaged stacks should be picked together and kept separate from the undamaged lot. They will be off-grade. If the good peanuts and bad peanuts are mixed together they will all be off-grade.

A good indication of damaged peanuts is a lot of mould on the vine nearest to the nuts. Some of the peanuts should be shelled out to make certain that they are damaged inside before being put in the damaged or off-grade lot.

Some peanuts are harder to pick clean than others. It is often desirable to run the peanuts through the picker the second time to take out the excess trash. Too much trash will reduce the percentage of kernels and thereby lower the grade.

Very few peanut growers own a peanut picker. They depend in most cases on custom pickers because the cost of the machine is too high for most farmers to own individually. The cost of the picker and power hay baler is from $800 to $900, with the power cost in addition. In Southeast Alabama the custom price for picking averages about $8.00 per ton, including baling the hay. Some pay $9.00 per ton and get the nuts hauled to market. At these prices the grower hauls the peanuts to the picker and moves the hay after it is baled. The average picker will pick from 4 to 8 tons of peanuts per day, depending of course, on the amount of moving that must be done.

Peanut Vines for Hay

In peanut producing areas peanut hay is very valuable as livestock feed if the vines have been properly cured. Henry and Morrison's "Feeds and Feeding" shows the following analyses of hays:

Hay	Digestible Nutrients in 100 Pounds			
	Crude Protein	Carbo-hydrates	Fat	Total
Peanut vines, pulled nuts removed	6.9	45.3	2.5	57.8
Soybean hay	11.7	39.2	1.2	53.6
Cowpea, all analyses	13.1	33.7	1.0	49.0
Alfalfa, all analyses	10.6	39.0	0.9	51.6
Lespedeza	8.6	41.1	1.1	52.2
Johnson grass	2.9	45.0	1.0	50.1

These analyses show very clearly that peanut hay compares favorably with other kinds of hay.

The summary of the 24 farms surveyed in Southeast Alabama does not show any hay crops used in the cropping system. The farmers in this area depend on the peanuts harvested to supply the needed hay for livestock.

In commercial producing areas peanuts are picked with power pickers and the hay is baled with power balers at the time the peanuts are picked, which reduces the cost of handling, because the picking charge includes hay baling.

Experimental results, together with the experiences of peanut growers, indicate that peanuts harvested and picked with a power picker will yield from 1000 to 2000 pounds of hay per acre.

The market price of peanut hay ranges from $7.50 to $12.00 per ton. The value of the hay will be in most cases pay for picking the peanuts, which makes the peanut hay a very important part of the peanut enterprise where the peanuts are harvested.

Digging and Hogging Peanuts

There are two ways of harvesting peanuts: by (1) digging and selling on the market or for home use as feed for livestock, or as food for the family; and by (2) harvesting with hogs, using the pork produced for home use or to sell on the market.

Producing peanuts and digging continuously from year to year has a very bad effect on the yield of succeeding crops. The peanut growers of Southeast Alabama say to never dig two successive crops of peanuts from the same field, but that peanuts dug should be grown in at least a three year crop rotation. Peanuts dug will decrease the yield of succeeding crops where peanuts harvested with hogs will increase the yield of succeeding crops. These points should be considered in setting up a cropping system that includes peanuts.

The Alabama Experiment Station has conducted some experiments showing the effect of digging and hogging peanuts. The results of these tests bring out very clearly that harvested peanuts draw heavily on soil fertility.

The Effect of Harvested Peanuts in Rotation of Corn, Cotton, and Peanuts on Yield of Cotton

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Wiregrass Substation, Headland, Alabama.

Purpose: To study various cropping systems involving cotton, peanuts and corn.

Period: 1932-1939.

Results:

THE EFFECT OF HARVESTED PEANUTS IN ROTATION OF CORN, COTTON AND PEANUTS ON YIELD OF COTTON

	Cotton in 2 Year Rotation with Corn*		Cotton in 3 Year Rotation of Corn, Cotton and Harvested Peanuts**			Cotton in 3 Year Rotation of Corn, Cotton and Harvested Peanuts***		
	Yields Per Acre		Yields Per Acre			Yields Per Acre		
Year	Corn Bu.	Seed Cotton Lbs.	Corn Bu.	Seed Cotton Lbs.	Peanuts Lbs.	Corn Bu.	Seed Cotton Lbs.	Peanuts Lbs.
1932	29.8		26.6			27.7		
1933		1764		1699			1622	
1934	31.7				1934			1960
1935		1656	40.2			31.3		
1936	18.1			1368			1298	
1937		1991			2197			2514
1938	27.5		32.1			29.2		
1939		1201		652			1075	

*Cotton fertilized with 600 pounds per acre of 6-8-4. Corn unfertilized.

**The corn and peanuts were unfertilized; the cotton was fertilized with 6-8-4 at the rate of 600 pounds per acre.

Two crops of harvested peanuts during the 7 year period injured the land to such an extent that 600 pounds of 6-8-4 produced only 652 pounds seed cotton per acre.

***The corn and peanuts were unfertilized, the cotton received 7-8-4 in 1933-1936 and 6-8-12 in 1939 at the rates of 600 pounds per acre.

In 1939, the cotton received 12 instead of 4 per cent potash in the fertilizer and produced 423 pounds per acre of seed cotton more than was produced by the 4 per cent potash.

Reference: Alabama Agricultural Experiment Station Leaflet 18, "The Effect of 'Digging' and 'Hogging' Peanuts on Cotton Yields," pages 1, 5, 6 and 7, Auburn, Alabama, October 1939.

The Effect of Digging and Hogging Peanuts on Cotton Yields

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Wiregrass Substation, Headland, Alabama.

Period: 1932-1939.

Purpose: To study various cropping systems involving cotton and peanuts.

Results:

THE EFFECT OF DIGGING AND HOGGING PEANUTS ON COTTON YIELDS

Year	Continuous Cotton*	Peanuts Harvested Continuously for 7 years, on Cotton the 8th Year**	Yield of Seed Cotton in Two Year Rotation with Hogged Peanuts***	
	Yield Seed Cotton Per Acre (Lbs.)	Yield Peanuts Lbs. Per Acre for 7 years and Yield Seed Cotton (Lbs.) 8th Yr.	Yield in Pounds Peanuts	Seed Cotton
1932	731	1852 peanuts	1531	
1933	1406	1212 peanuts		1503
1934	945	1938 peanuts	2113	
1935	1436	1395 peanuts		1492
1936	1366	2173 peanuts	2404	
1937	2063	1518 peanuts		1933
1938	1154	1066 peanuts	2419	
1939	1269	345 seed cotton		1174

*Fertilized with 600 pounds per acre of a 6-8-4. Under this condition, 4 per cent potash in the fertilizer seems to be sufficient.

**Cotton after seven years of harvested peanuts. The peanuts were unfertilized; the cotton received 600 pounds per acre of 6-8-8 fertilizer in 1939.

Seven crops of peanuts removed from the land injured it to such an extent that cotton considered to be well fertilized produced only 345 pounds per acre. Note the declining peanut yields in 1937.

***The cotton received 600 pounds per acre of 6-8-4 until 1939; peanuts received no fertilizer. In 1939, the cotton received 600 pounds per acre of 0-8-4. Under these conditinos, four per cent potash in the fertilizer appears to be sufficient.

In 1939, cotton without commercial nitrogen produced almost as much as continuous cotton which received 600 pounds per acre of 6-8-4. The peanut yields are high compared to peanuts continuously for 7 years.

Reference: Alabama Agricultural Experiment Station Leaflet 18, "The Effect of 'Digging' and 'Hogging' Peanuts on Cotton Yields," pages 1, 2, 3 and 4, Auburn, Alabama, October 1939.

Labor Requirements for Producing Peanuts

Labor requirements for producing peanuts were measured by the North Carolina Agricultural Experiment Station on thirty farms in two producing areas. Peanuts were grown in the Craven and Northampton areas. There were 20 farms with an average of 11.65 acres in the Northampton area as compared to 10 farms with an average of 6.2 acres in the Craven area. The average yield of nuts per acre of 1499.4 pounds for the Northampton area was much larger than the 650.5 pounds yield per acre for the Craven area. The cost per pound for the two areas was 1.9 cents and 3.5 cents respectively.

The man and horse labor requirements do not vary a great deal between the two areas. A little more of both man and horse labor was used on the average in the Northampton than the Craven area. This is to be expected, however, especially in the case of harvesting, for the yield was considerably larger in the Northampton area.

AVERAGE LABOR REQUIREMENTS PER ACRE FOR PEANUTS

Craven 1925; Northampton 1927

Area	No. of Farms	Av. No. of Acres Per Farm	Average Yield Per Acre	Man Labor			Horse Labor		
				Prior to Harvest	Harvest	Total	Prior to Harvest	Harvest	Total
Northampton	20	11.65	1499.4 nuts 1.56 hay	47.51	33.93	81.44	33.44	7.71	**41.15**
Craven	10	6.2	650.5 nuts .6 hay	41.12	27.39	68.51	31.34	5.57	36.91

Hay—tons

Nuts—pounds

LABOR REQUIREMENTS BY OPERATIONS PER ACRE ON PEANUTS

Craven 1925; Northampton 1927

Area	No. of Farms	Av. No. of Acres Per Farm	Average Yield Per Acre Lbs.*	Prior to Harvest															
				Breaking		Harrowing and Discing		Running		Distributing Lime and Fertilizer		Planting		Cultivating		Chop-ing	Total Hours	
				M	H	M	H	M	H	M	H	M	H	M	H	M	M	H
Craven	10	6.2	650.5	3.36	6.65	**3.24**	**5.61**	1.06	1.24	2.45	.53	2.76	1.93	13.5	15.38	14.75	41.12	31.34
Northampton	20	11.65	1499.4	5.61	**7.91**	**1.37**	**1.9**	1.39	1.53	3.20	1.58	6.82	4.58	13.90	15.94	15.22	47.51	33.44

Area	Harvesting								TOTAL HOURS	
	Digging		Cutting Poles, Stacking and Hauling		Threshing		Total Hours			
	M	H	M	H	M	H	M	H	M	H
Craven	19.13	2.95	1.26	**1.29**	7.0	1.32	27.39	5.57	68.51	36.91
Northampton	14.48	3.53	8.87	**2.18**	10.58	2.0	33.93	7.71	81.44	41.15

*Peanuts
M—Man hours
H—Horse hours

Reference: North Carolina Agricultural Experiment Station Bulletin 305, "Cost of Producing Farm Products in North Carolina," pages 72, 75 and 76, tables 56 and 58, Raleigh, North Carolina, June 1936.

Marketing

Marketing is a very important item with any crop that is produced. Before any enterprise is introduced the market possibilities should be determined.

There would be little need for producing a very large acreage of peanuts in Mississippi unless they could be marketed. There is a very limited established market for peanuts in Mississippi, but in other sections of the South there are established markets for peanuts the same as other crops, and as the peanuts are available there will no doubt be markets established in Mississippi.

The peanut growers of Southeast Alabama market their peanuts by selling through the Georgia, Florida, Alabama Peanut Growers Association, oil mills and local buyers.

Peanuts are sold by grades, as are other crops. The specifications for the different grades are given and how the grades are determined.

The prices for peanuts by months is given for all peanuts and for Southeastern Spanish and Runner varieties. This will give some idea as to prices that have been received for a number of years, and may be used as an indication of what price to expect for peanuts in the future.

Grading

In peanut producing areas peanuts are sold by grades. It is very necessary to have standard grades to sell by to protect the seller as well as the buyer. A high percent of farm products are sold by grades. The seller, for his own protection, should know what makes up the different grades.

The United States Department of Agriculture has standard grades set up for peanuts. These grades are used by peanut buyers in the peanut producing areas of the United States.

Small White Spanish peanuts are graded as follows:

Peanuts must be dry, mature, and practically free from damage.

After the SMALL SHRIVELED KERNELS have been sifted out through a screen with FIFTEEN SIXTY-FOURTHS of an inch by THREE-QUARTERS of an inch slotted holes, the balance of the kernels must be as follows:

No. 1 Grade

If there is 70% SOUND AND MATURE KERNELS, 2% of DAMAGED KERNELS is allowed.
If there is 71% or more S and M KERNELS, 3% of DAMAGED KERNELS is allowed.

No. 2 Grade

If there is 65% SOUND AND MATURE KERNELS, 2% of DAMAGED KERNELS is allowed.
If there is 66% SOUND AND MATURE KERNELS, 3% of DAMAGED KERNELS is allowed.
If there is 67% SOUND AND MATURE KERNELS, 4% of DAMAGED KERNELS is allowed.
If there is 68% or more S and M KERNELS, 5% of DAMAGED KERNELS is allowed.

No. 3 Grade

If there is 60% SOUND AND MATURE KERNELS, 2% of DAMAGED KERNELS is allowed.
If there is 61% SOUND AND MATURE KERNELS, 3% of DAMAGED KERNELS is allowed.
If there is 62% SOUND AND MATURE KERNELS, 4% of DAMAGED KERNELS is allowed.
If there is 63% SOUND AND MATURE KERNELS, 5% of DAMAGED KERNELS is allowed.
If there is 64% or more S and M KERNELS, 6% of DAMAGED KERNELS is allowed.

If peanuts grade lower than No. 3 they should be sold to an oil mill. The peanut grower should be interested in producing the No. 1 grade peanuts because the highest prices are paid for No. 1 peanuts. Peanut buyers had much rather buy No. 1 peanuts than the lower grades.

The peanut grower may determine the grade of peanuts to be sold by:

1. Take some peanuts from several places in any lot to be graded. Mix thoroughly and spread in thin layer on floor or table.

2. Take out two opposite quarters. Mix two remaining quarters, continue to mix and quarter down until only about 8 ounces are left.

3. Weigh exactly 8 ounces on a Percentage Scale, this will be the full sample or 100%.

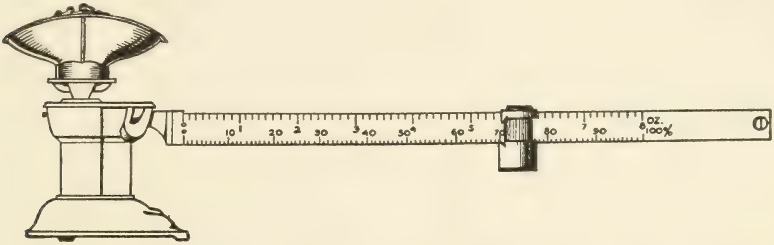

Figure 14—The Howe Scale Company and the Fairbanks-Morse Scale Company, both of Atlanta, Georgia, sell this scale.

4. Be careful not to lose or add any peanuts to the 8 ounces. If this is done, it will not be the original 100%.

5. Pick out "Foreign Material" on scale. Read figures on lower edge of scale; this is the percent of "Foreign Material" in the sample. There is no specified allowance of "Foreign Material," but every percent of it reduces the percent of kernels that much.

6. Pick out "Shelled Peanuts" and weigh. Read figure on lower edge of beam. This will be the percentage of "Shelled Peanuts" in the "Farmers Stock."

Shelled nuts will not run high if peanuts have been properly handled through a Peanut Picker. If they were run through a threshing machine the shelled nuts will be excessive.

7. Shell the sample by hand. Put kernels in one box and hulls in another. Do not drop any of the kernels or leave any in the hulls. Blow the chaff out of the kernels.

8. Shake the kernels over a fifteen sixty-fourths of an inch by three-fourths of an inch screen. This takes out the "Small Shrivels."

9. If any small, slick, immature peanuts pass through the screen, put back with the larger kernels. Weigh the "Small Shrivels" and read the percentage on the lower edge of the beam.

The "Small Shrivels" are sometimes called "Screenings." There is no specific allowance for these in any of the grades but the "Sound and Mature Kernels" will be low if the "Small Shrivels" are high.

10. Spread out the remaining kernels and pick out the "Damaged Kernels."

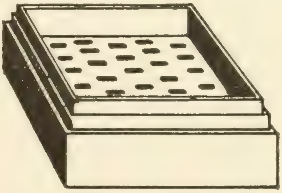

Figure 15—These screens with a catch tray can be bought from Huntley Manufacturing Company of Brocton, N. Y.

Rancid, decayed, moulded, sprouted, worm cut, kernels with dirt ground in, kernels with yellow meat under the skin or kernels having spots over one-fourth of the skin are considered "Damaged."

Weigh the "Damaged Kernels," read percentage on lower edge of scale beam.

2% to 3% is allowed for No. 1 Grade
2% to 5% is allowed for No. 2 Grade
2% to 6% is allowed for No. 3 Grade

11. Weigh the balance of kernels on scale and read percentage on lower edge of scale. These will be "Sound and Mature Kernels."

To grade No. 1 there must be at least 70% of "Sound and Mature Kernels, between 65% to 70% to Grade No. 2 and between 60% and 64% to Grade No. 3. Peanuts not coming up to these grades are not suitable for shelling and should be sold to oil mills.

AVERAGE PRICE RECEIVED FOR PEANUTS IN THE SHELL BY FARMERS

Year	Sept. 15	Oct. 15	Nov. 15	Dec. 15	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15	Aug. 15	Crop Year Av.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cents
1928	5.0	4.6	4.8	5.1	5.0	5.1	5.1	5.2	5.0	5.1	4.9	4.7	4.95
1929	4.6	4.4	4.0	3.8	3.7	3.5	3.5	3.5	3.7	3.6	3.7	3.8	3.80
1930	3.9	4.2	3.8	3.2	3.2	3.6	3.7	3.9	4.1	3.9	3.8	3.6	3.57
1931	3.1	2.3	2.2	2.0	2.0	1.9	2.0	1.9	1.7	1.6	1.4	1.7	2.05
1932	2.0	1.6	1.6	1.2	1.3	1.3	1.5	1.5	2.1	2.3	2.5	2.6	1.54
1933	2.5	2.5	2.7	2.6	2.9	3.1	3.2	3.4	3.4	3.3	3.2	3.3	2.83
1934	3.3	3.2	3.1	3.3	3.5	4.1	4.4	4.4	4.4	4.1	3.9	3.4	3.29
1935	3.4	3.3	3.1	3.0	3.0	3.1	3.0	3.1	3.3	3.3	3.7	3.8	3.13
1936	3.7	3.5	3.3	3.6	4.1	4.1	4.2	4.5	4.4	4.2	4.0	3.7	3.71
1937	3.4	3.2	3.2	3.2	3.0	3.4	3.5	3.5	3.4	3.5	3.5	3.4	3.21
1938	3.2	3.2	3.3	3.3	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.28
1939	3.4	3.4	3.4	3.4	3.5	3.6							

Reference: United States Department of Agriculture Agricultural Statistics 1939, page 292, table 407.

PEANUTS: AVERAGE PRICE PER POUND TO GROWERS, F. O. B. COUNTRY SHIPPING POINT BASIS

SOUTHERN SPANISH

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Av.
Year	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
1930-31	3.2	3.1	2.8	3.0	3.4	3.4	3.6	3.6	3.5	3.2	2.8	3.6	3.3
1931-32	1.2	1.2	1.2	1.2	1.2	1.4	1.2	1.0	.8	.8	1.3	1.5	1.2
1932-33	1.2	1.1	.9	1.1	1.1	1.2	1.4	2.1	2.4	2.7	2.7	1.4	1.6
1933-34	2.4	2.5	2.5	2.8	2.7	2.8	2.6	2.6	2.7	2.7	2.7	2.2	2.6
1934-35	2.7	3.0	3.4	4.0	5.0	5.3	4.7	4.6	4.0	3.4	....	2.8	3.9
1935-36	2.9	2.9	2.9	2.7	2.7	2.8	2.9	3.0	3.0	3.4	3.3	3.1	2.9
1936-37	3.0	3.1	3.8	4.4	4.3	4.5	4.4	4.1	3.5	3.5	2.9	3.2	3.7
1937-38	3.0	3.2	3.1	3.2	3.2	3.2	2.9	2.9	3.0	3.0	2.9	2.7	3.0
1938-39													

SOUTHEASTERN RUNNERS

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Av.
Year	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
1930-31	2.3	2.2	....	....	....	....	....	....	....	....	....	....	2.2
1931-32	1.0	1.0	1.0	.8	.8	1.0	0.9	0.8	0.6	0.8	....	....	0.9
1932-33	1.0	.8	.6	.9	.9	1.0	1.1	1.6	1.8	....	....	....	1.1
1933-34	2.1	2.1	2.1	2.4	2.5	2.6	2.5	2.5	2.5	2.5	2.5	....	2.4
1934-35	2.4	2.5	3.0	3.3	4.2	4.0	....	....	3.8	....	....	2.4	3.2
1935-36	2.5	2.5	2.5	2.5	2.5	2.4	2.5	2.6	2.5	3.1	3.2	2.5	2.6
1936-37	2.4	2.6	3.2	3.5	3.4	3.7	4.0	3.5	3.3	2.8	2.6	....	3.2
1937-38	2.6	2.7	2.6	2.6	2.7	2.3	2.3	2.3	2.5	2.6	....	....	2.6
1938-39													

Reference: United States Department of Agriculture Agricultural Statistics 1939, page 292, table 408.

Insect Pests and Diseases of Peanuts

For a long time peanut growers and research workers considered the peanut crop practically immune to the attacks of insect pests and plant diseases. This belief was based on the fact that the entire crop is not destroyed by such attacks when no control measures are used, as is often the case with other crops. The presence of both insects and diseases on peanuts has been observed for a long time, but only recently has any experimental work been conducted to identify such pests and diseases and to develop control measures for them.

The potato leafhopper and leaf spot are known to do considerable damage to the peanut crop. During the last few years Virginia has conducted a series of experiments on control methods for the potato leaf hopper, and Georgia has started a series of tests on the control of leaf spot. These experiments have not been conducted over a long period, but the results that have been gotten should serve as a guide as to how potato leafhoppers and leafspot may be controlled and an indication as to the increase in yields that may be obtained by using the control methods.

Spraying and Dusting to Control Potato Leafhopper on Peanuts

Conducted by: Virginia Agricultural Experiment Station.

Conducted at: Holland, Virginia.

Period: 1935, 1936 and 1937.

Purpose: To study the control of the potato leaf hopper.

Procedure and Conditions: The Potato Leafhopper—It is not surprising that most growers are not familiar with this small green insect, which is only about one-eighth inch in length when full-grown. It is wedge-shaped in appearance and is yellowish to pale green in color. This very active little species feeds largely on the lower surfaces of the leaves and is capable of jumping or flying when disturbed. The young or immature stages as well as the adults have the unusual ability to run backward or sidewise as rapidly as they can move forward. Frequently when one seeks them on the lower surface of the leaf, they dart around to the upper side without being observed. The egg is a small whitish object, slightly less than one-twenty-fifth inch in length and is not easily observed. The young hoppers are known as nymphs and are similar to the adult in shape but do not have full-grown wings. In their early stages these nymphs are so small and pale-colored that they are difficult to see. During the last three nymphal or immature stages the partially developed wing (wing pads) are present on each side of the body. At the end of the fifth nymphal stage the adult appears and it has full-grown wings. The wings are usually of a paler green color than the rest of the body. The tibia (the longest segment) of each of the hind legs is equipped with two rows of green spines.

Life History: The eggs are deposited in the petitoles or larger veins of the leaves where they usually hatch within 4 to 9 days during the summer.

The young nymphs pass through four succeeding immature or nymphal stages in their life cycle, shedding their skins at the end of each stage until the adult stage is reached. Soon after the adults appear mating takes place and within a few days eggs are deposited, and a new life cycle begins. The period required for this insect to develop from egg to adult, under most favorable conditions is about 3 weeks. Figure 16 illustrates the life history of the potato leafhopper.

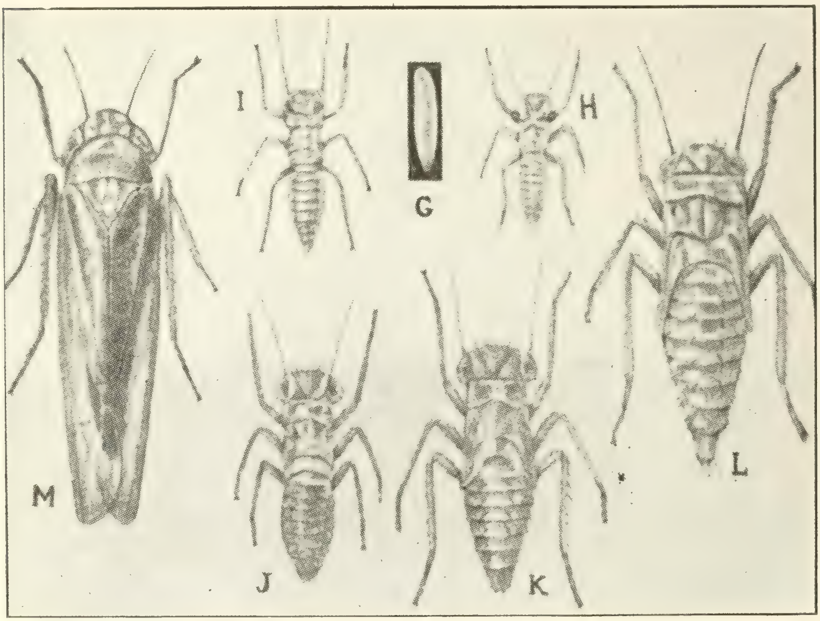

Figure 16—The potato leafhopper (much enlarged). G, egg; H to L, first to fifth instars or immature stages; M, adult.

Studies under controlled conditions in an out-of-doors insectary at Arlington Experiment Farm, Arlington, Virginia, showed that this species developed six generations in the period from May to October, inclusive. Under field conditions the generations overlap and cannot be definitely distinguished. The potato leafhopper has a wide variety of host plants. At temperatures between 85° and 90° F., on host plants of exceptional succulence, this species multiplies very rapidly, often becoming extremely abundant on peanuts in Virginia and North Carolina within a period of a few weeks during July and August.

The potato leafhopper frequently does considerable damage to the peanut plants by piercing the leaves and petioles and sucking the juices from them. A burning of the tips and margins of the leaves and a yellowing and dwarfing of the foliage are common symptoms of the disease like injury, which decreases the yield of forage and nuts materially. The same species of leafhopper injures potatoes severely in many parts of the United States, by causing the injury know as "hopperburn." The potato is one of the preferred food plants of the leafhopper and it often becomes very abundant on this crop. To aid in preventing movement of heavy population of these insects from potatoes to peanuts, it is advisable to avoid planting peanuts adjacent to early potatoes. Figure 17 illustrates how the potato leafhopper injures the peanut plant.

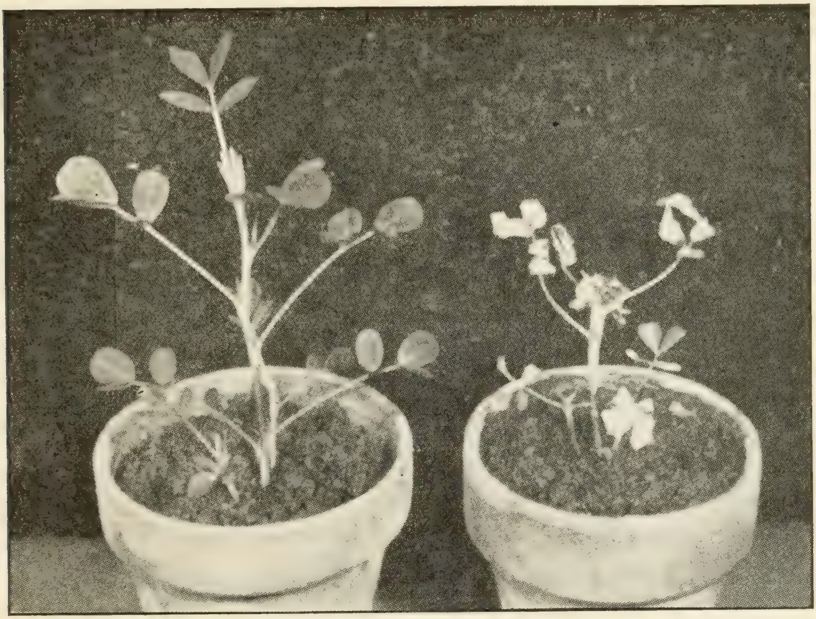

Figure 17—Injury caused by potato leafhopper.

1935 Experiments: The tests were designed especially to study the effect of various sprays and dusts on yields of peanuts. These tests are listed in the results. Bordeaux spray (2, 3 and 4 applications), Bordeaux dust (3 applications), and the materials used as soil treatments were each applied to four plots. Only duplicate plots were available for the application of the following materials: Copper carbonate, copper sulphate, Bordeaux dust (2 applications) and sulphur (2 and 3 applications). There were 10 check plots distributed among the series of plots.

Sprays: Copper phosphate and copper carbonate were also used as sprays during 1935. The copper phosphate mixture (and similarly the copper carbonate mixture) was mixed dry at the rate of 2 pounds of copper phosphate to 4 pounds of hydrated lime and 2 pounds of bentonite. Care was taken to use in each tank of spray material an amount of copper phosphate or of copper carbonate equal in copper content to that in the Bordeaux mixture so that the results could be compared on this basis.

Dusts: Bordeaux mixture and sulphur in the form of dust were applied to peanuts.

Soil Treatments: Copper sulphate and manganese sulphate each was applied to the soil at the rate of 50 pounds per acre, and zinc sulphate was applied at the rate of 30 pounds per acre during 1935. These materials were applied in the furrow at planting time. The results indicated that these materials had no significant value and they were excluded from the tests made during 1936 and 1937.

There was much earlier shedding of leaves on the untreated check plots and on those which soil treatments were applied at planting time than on the plots to which dusts and sprays were applied. The untreated plots were harvested on November 1, whereas the treated plots remained green and were allowed to grow until November 15. The vines were killed by frost on November 14 but had remained green and had retained most of their leaves until that date. There were no marked differences in this respect in connection with any of the treated plots. The results obtained during 1935, which appear to be significant, were the increases in yield of from 36 to 50 percent obtained by the application of Bordeaux mixture used as a spray and the increase in yield of about 35 percent obtained by the application of the sulphur dust.

SUMMARY OF TESTS TO CONTROL POTATO LEAF HOPPER ON PEANUTS AT HOLLAND, VIRGINIA, 1935-1937

Treatment	1935			1936			1937					Ave. Yield of Nuts Lbs.	Ave. Inc.
	Date of Application	Yield Nuts Per A. Lbs.	Yield Inc.	Date of Application	Yield Nuts Per A. Lbs.	Yield Inc.	Date of Application	Yield Nuts Per A. Lbs.	Yield Inc.	Yield of Forage	Inc.		
Untreated Check		1296			1200			1782		3548		1426	
4 sprays Bordeaux mixture	July 4, 11 Aug. 12, 22	1830	534				July 15 Aug. 4 Sept. 1, 20	2016	234	4314	766	1923	497
3 sprays Bordeaux mixture	July 11 Aug. 12, 22	1944	648	July 22 Aug. 12 Sept. 2	1752	552	July 15 Aug. 4 Sept. 1	2382	600	4446	898	2026	600
2 sprays Bordeaux mixture	July 11 Aug. 22	1770	474	July 22 Aug. 12	1872	672	July 15 Sept. 1	2016	234	3984	436	1889	463
3 sprays copper carbonate	July 11 Aug. 12, 22	1812	516	July 22 Aug. 12 Sept. 2	1872	672	July 15 Aug. 4 Sept. 1	1884	102	3684	136	1856	430
3 sprays copper phosphate	July 11 Aug. 12, 22	1542	246	July 22 Aug. 12 Sept. 2	1872	672	July 15 Aug. 4 Sept. 1	1980	198	3720	172	1798	372
3 dusts Bordeaux mixture	July 11 Aug. 12, 22	822	—474	July 22 Aug. 12 Sept. 2	1602	402	July 15 Aug. 4 Sept. 1	1770	—12	3156	208	1398	— 28
2 dusts Bordeaux mixture	July 11 Aug. 22	1140	—156	July 22 Aug. 12	1710	510	July 15 Sept. 1	1782	....	3792	244	1544	118
4 dusts sulphur							July 15 Aug. 4 Sept. 1, 20	2106	324	5274	1726		
3 dusts sulphur	July 11 Aug. 12, 22	1752	456	July 22 Aug. 12 Sept. 2	1632	432	July 15 Aug. 4 Sept. 1	1974	192	5004	1456	1786	360
2 dusts sulphur	July 11 Aug. 22	1710	414	July 22 Aug. 12	1752	552	July 15 Sept. 1	2010	228	5190	1642	1826	400
3 dusts pyrethrum sulphur				Aug. 12 July 22 Sept. 2	1752	552	July 15 Aug. 4 Sept. 1	2280	498	5154	1606	2016	590
2 dusts pyrethrum sulphur				July 22 Aug. 12	1560	360	July 15 Sept. 1	2064	282	4824	1276	1812	386
50 lbs. copper sulphate per acre to the soil	At planting time	1404	108										
30 lbs. sulphate per acre	At planting time	1350	54										
50 lbs. magnesium sulphate	At planting												

1936 Experiments: In 1936 the plan of the work was varied slightly and enlarged. No soil treatments were made. A pyrethrum-sulphur compound (25 percent pyrethrum and 69 percent sulphur) in the form of dust was included among the materials tested. To determine the number of applications necessary in order to obtain the best yield, two applications of each material were applied to each of four plots and three applications of each material to each of four plots. Bordeaux mixture, copper phosphate, and copper carbonate were applied as sprays and sulphur, pyrethrum-sulphur, and Bordeaux mixture were applied as dusts. Eleven untreated check plots were distributed uniformly throughout the experimental area.

Owing to extremely dry soil conditions prevalent in May, planting was delayed until June 1, which retarded somewhat the normal development of the peanut crop. A light frost occurred on October 15 and a killing frost on October 29. All plots were dug November 2. Despite the lateness of planting, the untreated check plots were nearly mature on October 29 but the treated plots were still green and in a thrifty growing condition.

1937 Experiments: The plan of the tests for 1937 was identical with that of 1936, except for the addition of two series of plots to which four applications of Bordeaux mixture as a spray and four applications of sulphur as a dust were applied. These tests were added in order to get additional information regarding the number of applications which should be made in order to obtain the best results.

During July and the early part of August 1937, the peanut crop in the Holland section suffered from the heaviest infestation by the potato leafhopper that has been observed during the past several years. This was especially true of peanuts planted near fields of early potatoes. These insects appeared in potato fields in large numbers, greatly curtailing the yield of this crop, and when the potato vines died, or the crop was harvested, the leafhoppers migrated to the nearby peanut fields. Characteristic injury to the peanut foliage was noted early in July and by the last week of the month all plants in some of the fields appeared as though they had been burned. Although this unusually heavy infestation of leafhoppers began to subside early in August, and the plants then made much new growth, the yields both of field-cured nuts and of forage were greatly curtailed. On the plots at the experiment station at Holland the leafhopper infestation was not so heavy as in some of the other sections of the peanut-growing area, but it was much heavier than is normal there.

Reference: Virginia Agricultural Experiment Station Bulletin 316, "Spraying and Dusting to Control the Potato Leafhopper on Peanuts in Virginia," pages 4, 5, 6, 8, 9, 10, 11, 12 and 14, tables 1, 2, and 4, Blacksburg, Virginia, April 1938.

Dusting Spanish Peanuts with Sulphur

Conducted by: Georgia Agricultural Experiment Station.

Conducted at: Ten farms in four counties, namely: Terrell, Tift, Mitchell and Daugherty.

Period: 1937.

Purpose: To determine the proper schedule for dusting Spanish peanuts under Georgia conditions and whether such dusting with sulphur might prove profitable.

Procedure and Conditions: A 325 mesh sulphur was used at the rate of approximately 16 pounds per acre for each application. Dusting was begun during the first week in July.

Three dusts were applied for all tests except in Terrell County where four applications were made. The interval between applications was two weeks in all tests except one in Terrell County where the interval was reduced to one week.

In all fields there was a distinct observational difference between the dusted and undusted areas, particularly near harvest time. The appearance of the dusted and undusted vines was similar until about two weeks before harvest when the leaves began shedding rapidly from the undusted vines. Vines receiving sulphur retained from one-half to two-thirds of all leaves, while undusted vines shed all but a few top leaves. The stems of the dusted plants were green while the undusted were brown and dry in appearance. There was leaf-spotting on the dusted plants, the amount present being dependent on the prevalence of spotting at time of first dusting, but leaf-spot control alone did not seem adequate to explain the resulting increases in yields.

There were increased yields of cured peanuts in all but one instance. The cause of failure in this case is not known. Low increase in yields might be attributed in several instances to lateness in applying the first dust, since the date to begin dusting must be based on the condition of the plants. Also, in several cases, yield increases were small because dust coverage was too light. The dust used was unconditioned and tended to clog the duster, thus interfering with the rate of delivery.

Results:

SUMMARY OF TESTS WITH A 325 MESH SULPHUR AS A DUST ON SPANISH PEANUTS

County	Farm No.	No. of Applications	Yield Peanuts Increase Per Acre		Increase Per Acre	
			Dusted	Untreated		
			Pounds	Pounds	Pounds	Per Cent
Mitchell	1	3	2598	2193	405	18.5
	2	3	958	848	110	12.9
	3	3	1195	1137	58	5.1
Daugherty	1	3	1187	1023	164	16.0
	2	3	752	848	--96	—11.3
	3	3	1332	1072	261	24.3
Tift	1	3	2155	1648	506	30.7
	2	3	2059	1847	212	11.5
Terrell	1	4	1600	900	700	77.7
	2	4*	1384	1144	240	20.9
Averages			1522	1266	256	20.2

*One-week intervals, all others were applied at two-week intervals.

Reference: Georgia Agricultural Experiment Station Circular 117, "Dusting Spanish Peanuts with Sulphur," pages 1, 2 and 4, table 1, Experiment, Georgia, May 1939.

Dusting Spanish Peanuts with Sulphur

Conducted by: Georgia Agricultural Experiment Station.

Conducted at: One farm in each of the six counties: Tift, Early, Terrell, Mitchell, Decatur and Berrien.

Period: 1938.

Purpose: To determine the proper schedule for dusting Spanish peanuts under Georgia conditions and whether such dusting with sulphur might prove profitable.

Procedure and Conditions: In 1938 a series of 30 plots was staked out in each field. From these a series of 10 plots was dusted twice at two-week intervals, while a second series of 10 plots was dusted three times at two week intervals. Five plots in each series received 10 to 15 pounds of sulphur per acre at each application while the other five plots received 15 to 20 pounds of sulphur per acre at each application. The remaining 10 plots were reserved as undusted checks.

Leaf-spot counts and yield records were made from these plots; but because of the unusual planting date these records were not included with those from our other field tests.

The peanuts in Tift county were planted April 15 and a good stand was obtained. The plot was fertilized with 0-10-4 at 400 pounds per acre. Tobacco had been grown on the land the previous year and had received 1,000 pounds of 4-8-8. The peanuts were dusted on July 9 and 22, and August 5. They were harvested August 23.

In Terrell county the peanuts were planted April 9, received 200 pounds 3-9-5 and a good stand was obtained. Seventy-five pounds nitrate of soda was applied the previous year to corn. The peanuts were dusted July 11 and 25, and August 9 and harvested August 18.

No fertilizer was applied to the peanuts planted April 10 in Mitchell county, and only a fair stand was obtained. The previous crop was corn and runner peanuts. No fertilizer was applied. July 13 and 28 and August 11 were the dusting dates. The crop was harvested August 19.

The Decatur county plot was planted May 1, no fertilizer was applied and a good stand was obtained. The previous crop was cotton and had received 400 pounds 3-9-5 and had been top-dressed with 75 pounds nitrate of soda. Sulphur dust was applied July 12 and 27, and August 10. The peanuts were harvested August 30.

Results:

DUSTING SPANISH PEANUTS THREE TIMES WITH SULPHUR IN FOUR GEORGIA COUNTIES IN 1938

County	Yield Peanuts Per Acre Lbs. Sulphur Applied Per Acre			Increase Per Acre Lbs. Sulphur Applied Per Acre			
	45-55*	30-40**	Undusted	45-55*	30-40**	45-55*	30-40**
	Pounds	Pounds	Pounds	Pounds	Pounds	Percent	Percent
Tift	2617	2610	2319	298	291	12.85	12.54
Terrell	1359	1386	1268	91	119	7.17	9.3
Michell	878	899	737	141	162	19.1	21.9
Decatur	1836	1669	1414	422	255	26.6	18.03
Averages	1672.5	1641	1434.5	238.0	206.5	16.5	14.39

*Total amount three applications.

**Total amount two applications.

The response to sulphur dust was evident in all dusted fields. Rainfall was far below normal and Spanish peanuts matured earlier than usual. In some fields dry weather caused extensive early leaf shedding and the crop was harvested earlier than normally would have been the case had the plants retained their leaves. This condition influenced the yield increases to some extent.

The amount of dust applied varied somewhat due to difficulty in calibrating the duster; however, the rates applied came within the range indicated in the table of results. Since both the size of the vines and the number of vines per given area varied in the different fields, the results for the rates of application cannot be considered conclusive. Less than 10 pounds per acre is inadequate for good coverage of all leaves. The average crop required at least 15 pounds for the first application with an increase to 20 pounds for the second and third.

Dusting in fields was begun a week or ten days later than the optium time. In certain instances the beneficial effects of the sulphur were further reduced by early maturity on account of drought. In Terrell County afternoon showers following each dusting washed off some of the sulphur, thus probably minimizing the results. However, it will be noted that three dustings of sulphur increased the yield in all tests. The highest percentage increase was in Decatur County where the crop was planted late, hence the condition of the plants was not as far advanced at the first dust application as in the other fields. It will also be noted that the highest percentage increase in yield was on peanuts which were not fertilized.

Reference: Georgia Agricultural Experiment Station Circular 117, "Dusting Spanish Peanuts with Sulphur," pages 1, 2, 4, 5 and 6, tables 2 and 3, Experiment, Georgia, May 1939.

The Effect of Various Treatment on Yield of Spanish Peanuts

Conducted by: Georgia Coastal Plain Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1938.

Purpose: To determine whether sulphur has any beneficial effects on peanuts other than disease control.

Procedure and Conditions: The first dust and spray was applied early on a crop that had been planted late and very little leaf-spot was present at this time. Therefore the sulphur dust and Bordeaux were more effective in controlling leaf-spot and preventing leaf shed.

The test has been run only one year and the results cannot be considered as more than suggestive, but they may be of interest to persons planning peanut studies.

Results:

YIELD OF SPANISH PEANUTS FROM PLOTS RECEIVING TREATMENT AS LISTED*

Treatment	Lbs. Per Acre		Increase Per Acre	
	Nuts	Hay	Nuts	Hay
Sulphur—3 dusts	3135	3111	765	716
3-4-50 Bordeaux—3 sprays	3042	3446	672	1051
Landplaster—100 lbs. per acre	3011	2384	641	—11
Sulphur in soil—30 lbs. per acre	2967	2426	697	31
Kainit in soil—125 lbs. per acre	3125	2784	763	389
Complete fertilizer—200 lbs. 6-10-6 per acre	2918	2384	548	—11
Check (no summer treatment)	2370	2395		

*All plots received 200 pounds of a 6-10-6 NPK fertilizer per acre before planting on April 25. The kainit and sulphur in soil were applied to the soil as side dressings on June 29, the complete fertilizer June 27. The first sulphur dust was applied July 1, and the first Bordeaux spray July 5. The landplaster was sprinkled on the plants June 29.

All plots were harvested August 29.

From the data listed one can readily see that Bordeaux gave slightly better disease control than did the sulphur dust, yet the sulphur dust gave significantly greater increase in yield of nuts. Sulphur in the soil gave only slight control of leaf-spot but did give a good increase in yield of nuts. Landplaster ($CaSO_4$) gave a very similar increase in yield of nuts, which would seem to indicate that a part of the increase is due to the nutrient value of sulphur. While all other possible factors (for example, the solvent action of oxidized sulphur in the soil, or the value of calcium in landplaster) have not been eliminated, this explanation appears most plausible from the data at hand. This phase of the study will need to be continued over a period of years and on various soil types before definite conclusions may be reached.

Reference: Georgia Agricultural Experiment Station Circular 117, "Dusting Spanish Peanuts with Sulphur," pages 7 and 8, table 4, Experiment, Georgia, May 1939.

Peanuts for Pork Production

According to the 1935 census Mississippi had a total of 311,683 farms. Of this total, 219,727 reported hogs on farms January 1. This leaves a total of 91,956 farms or 29.5% of the Mississippi farms without hogs. These facts would indicate that at least 29.5% of the farms in Mississippi have a problem of supplying the needed pork for home consumption. Pork needed for home use can be obtained only by: (1) purchasing the needed pork for home use, which in some cases is not done due to the low cash farm income, and results in many families going without sufficient pork; or (2) producing the needed pork on the home farm. This may be done by using the feeds that are now available on the farm, or by producing crops not now being grown to be used in producing pork.

At the present time while cooperating under the Soil Conservation program, many farmers are confronted with the problem of land utilization; that is, trying to use their land to the best advantage. Probably on most Mississippi farms pork production for home use offers a most profitable means to utilize sufficient cultivated land to produce the necessary feed. This land may be planted to several different crops to produce the pork; but under the Soil Conservation Program each farm has a soil depleting base set up and farms which exceed this soil depleting base are subjected to penalties. This causes some farmers not to have enough feed available for the production of the needed pork and makes it necessary to produce pork with crops that are classed as soil conserving. Examples of such crops are soybeans and peanuts. Peanuts grown and harvested with hogs are classed as a soil conserving crop. By growing peanuts and hogging them off, the needed pork can be produced and the soil be improved at the same time.

Peanuts have been found to be very satisfactory in the production of pork by the Alabama, Mississippi and Georgia Experiment Stations. The following experiments conducted by the Alabama, Mississippi and Georgia Experiment Stations give the results of tests using peanuts in the production of pork as compared with other feeds.

Peanuts for Fattening Hogs in Dry Lots

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: The farm of Parke Thompson, Goshen, Alabama.

Period: 1921-1923.

Purpose: To determine the amount of picked runner peanuts required to produce 100 pounds of gain on fattening hogs in the dry lot.

To compare the relative feeding value of runner peanuts alone; peanuts and corn; peanuts and tankage; and peanuts, corn and tankage.

To test the influence of the above rations on the quality of the carcass.

Procedure and Conditions:

Animals used: All hogs were purebred Poland China of the large type.

Quarters: The quarters were dry lots containing shelter.

Weighing: Individual weights were made at the beginning and every 28 days throughout the test.

Rations: The following rations were fed:

Lot 1—Runner peanuts, self-fed
Lot 2—Runner peanuts
Shelled corn
Free choice

Lot 3—Runner peanuts
60% tankage
Free choice

Lot 4—Runner peanuts
Shelled corn
60% tankage
Free choice

The hogs had access at all times to water and to a simple mineral mixture composed of equal parts by weight of air-slaked lime, salt, and charcoal.

Results:

PEANUTS FOR FATTENING HOGS IN DRY LOT

	First Experiment Dec. 14, 1920—March 21, 1921				Second Experiment Feb. 8—April 23, 1922				Third Experiment Feb. 2 to April 3, 1923			
	Lot 1	Lot 2	Lot 3	**Lot 4**	Lot 1	Lot 2	Lot 3	**Lot 4**	Lot 1	Lot 2	Lot 3	**Lot 4**
Number of hogs to lot	6	6	6	**6**	6	6	6	6	6	6	6	6
	Lbs.	Lbs.	Lbs.	**Lbs.**	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Average initial weight	116.0	117.0	116.0	**117.0**	76.0	75.8	75.3	75.3	122.0	122.6	120.5	122.5
Average final weight	309.0	282.0	317.0	300.0	194.8	199.5	212.0	227.0	274.0	268.0	285.0	279.0
Average daily gain per hog	1.98	1.69	2.06	**1.88**	1.58	1.65	1.82	2.02	2.54	2.42	2.74	2.61
Average daily feed per hog												
Runner peanuts	7.07	4.15	7.30	**4.45**	5.65	4.82	6.38	5.51	9.45	4.75	9.60	6.01
Shelled corn	....	3.15	....	**2.20**	....	1.90	....	1.73	....	4.83	....	3.53
60% tankage	....	....	0.12	**0.12**	....	....	0.40	0.21	....	....	0.16	0.12
Total	7.07	7.30	7.42	**7.77**	5.65	6.72	6.78	7.45	9.45	9.58	9.76	9.66
Feed for 100 pounds gain												
Runner peanuts	356.0	247.0	354.0	290.0	356.9	292.0	349.7	272.5	372.6	196.0	350.2	230.8
Shelled corn	....	183.0	....	117.0	....	115.3	....	85.6	....	199.4	....	135.4
60% tankage	....	....	5.7	6.3	....	....	21.6	10.9	....	....	5.9	4.7
Total	356.0	430.0	359.7	413.3	356.9	407.3	371.3	369.0	372.6	395.4	356.1	370.9

Unfortunately a record of the amount of mineral mixture consumed was not kept in any of these experiments.

The hogs in Experiment 1 were slaughtered at the plant of Swift & Company, Andalusia, Alabama. All carcasses were soft and oily.

The hogs from the second experiment were slaughtered at the plant of the Birmingham Packing Company, Birmingham, Alabama. All carcasses were soft or oily. The carcasses of Lots 1 and 3 appeared somewhat softer than those of Lots 2 and 4 but there was not enough difference to affect the commercial value.

The experiment 3 hogs were sold to a local dealer. Slaughter data were not obtained, as the results of the two former experiments showed that these rations produced soft or oily carcasses.

Reference: Alabama Agricultural Experiment Station Bulletin 223, "Peanuts for Fattening Hogs in the Dry Lot," pages 2, 3, 4, 5, and 6, tables 1, 2, and 3, Auburn, Alabama, June 1924.

Feeding System for Spring and Fall Litters at Tifton, Georgia

Conducted by: Georgia Coastal Plains Experiment Station.

Conducted at: Tifton, Georgia.

Period: 1935-1937.

Purpose: To compare the pork production on different feeds.

Procedure and Conditions: The 1935 spring litter feed periods were as follows:

Lot 1—April 23 to July 15
Lot 2—July 16 to August 7
Lot 3—August 8 to August 31
Lot 4—September 1 to September 24
Lot 5—September 25 to November 15
Lot 6—November 16 to December 10

The feeding periods for the 1936 spring litters were as follows:

Lot 1—May 5 to July 14
Lot 2—July 15 to August 14
Lot 3—August 15 to September 29
Lot 4—September 30 to October 26
Lot 5—October 27 to November 9

Results:

CONTINUOUS FEED PROGRAM FOR HOGS AT TIFTON—SPRING LITTER 1935

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
No. pigs to lot	38	38	41	41	41	30
Feeding period, days	84	23	24	24	52	24
Grazing Crops (acres)						
Mature oats	5.4					
(Otootan soybeans (no beans set) green grazing		2.2				
Grohoma sorghum (mature) and Otootan soybeans (no beans set)			3.4			
Grohoma sorghum (mature) and Spanish peanuts (mature)				4.1		
Corn (mature) and Hayseed Soybeans (mature)					8.3	
Dry lot on corn and tankage						....
Supplement						
Corn (lbs.)	3958	592				5544
Tankage (lbs)	345	31	47	177	215	155
Cottonseed meal (lbs.)	235	21	32	118	142	104
Total gain (lbs.)	1642	556	598	1324	3046	1490
Total gain per acre (lbs.)	304	253	176	323	367	....
Gain per day per pig (lbs.)	.52	.65	.61	1.35	1.63	2.07
Acres per pig for the period grazed	.142	.057	.082	.100	.202	....

A mineral mixture was self-fed at all times.

CONTINUOUS FEEDING PROGRAM FOR HOGS AT TIFTON, GEORGIA
SPRING LITTER—1936

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Number pigs to lot	56	52	52	39	9
Feeding period (days)	71	31	46	27	14
Grazing crop (acres)					
Mature oats	3.9				
Early White Dent Corn (Hastings Early) White Dent		6			
Grohoma Sorghum and Spanish Peanuts			5.45		
Corn and Hayseed Soybeans				8.45	
Dry lot on corn and protein supplement					....
Supplements					
Corn (lbs.)	6719				832
Tankage (lbs.)	907	871	1048	467	63
Cottonseed meal (lbs.)	604	580	698	312	42
Total gain (lbs.)	3141	3210	2229	1054	137
Total gain per acre (lbs.)	805	535	409	128	....
Gain per day per pig (lbs.)	.79	1.98	.98	1.00	1.17
Acres per pig for period grazed	.069	.115	.104	.217	....

Note: A mineral mixture was self-fed.

Pigs in the fall litters were weaned on October 22 and November 12 and placed on 7.9 acres of corn and runner peanuts. The crop was planted with one row of corn to four rows of runner peanuts. The yields were 1655 pounds of peanuts and 436 pounds of corn per acre. There was an average daily consumption of .2 pound of tankage per pig during the 81-day period. The daily gain averaged .98 pound per pig. The corn and runner peanuts produced 480 pounds of pork per acre.

On January 11, the 44 pigs were taken from the corn and runner peanuts and placed on nine acres of runner peanuts. The peanuts made an average yield of 2398 pounds per acre. There was an average daily consumption per pig of .28 pound of tankage during the 56-day period. An average daily gain of 1.37 pounds per pig was obtained. Runner peanuts produced 374 pounds of pork per acre. The pigs were fed a mineral mixture during the time they were grazing this area of peanuts and also during the previous period they were grazing the area of peanuts and corn.

References: Georgia Coastal Plain Experiment Station Sixteenth Annual Report 1935-1936, page 59, Tifton, Georgia, September 1936.

Georgia Coastal Plain Experiment Station Eighteenth Annual Report 1937-1938, pages 72 and 73, Tifton, Georgia, July 1938.

Peanuts Grazed Alone versus Peanuts Grazed Supplemented with Corn and Cottonseed Meal Self-Fed

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: October 20, 1920 to November 17, 1920.

Procedure and Conditions: In the fall of 1920, sixteen pigs averaging 47.12 pounds were divided into two lots of eight each. Lot 1 was grazed on peanuts alone while lot 2 was grazed on a comparable area of peanuts and in addition was allowed access to a self-feeder containing a mixture of two parts ground corn and one cottonseed meal. Lot 2 receiving corn and cottonseed meal made forty pounds more gain than lot 1 on peanuts alone. To produce this extra gain the pigs in lot 2 consumed 258.5 pounds of the mixture of corn and cottonseed meal, the small consumption of grain evidencing the palatability of the peanuts.

Results:

GRAZING PERIOD: OCTOBER 20, 1920 TO NOVEMBER 17, 1920

	Peanuts Grazed Alone	Peanuts Grazed Supplemented with Corn and Cottonseed Meal
Number of pigs used	8.	8.
Length of grazing period (days)	28.	28.
Average initial weight (lbs.)	47.12	47.12
Average final weight (lbs.)	83.37	88.37
Average gain per pig (lbs.)	36.25	41.25
Average daily gain per pig (lbs.)	1.29	1.47
Grain fed per pig (lbs.)	———	32.5
Average amount of grain fed daily (lbs.)	———	1.16
Grain fed per cwt. of gain (lbs.)	———	78.9

Grazing Trials with Peanuts at State College, Mississippi

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College, Mississippi.

Period: 1919-1922.

Procedure and Conditions: Grazing trials with peanuts were conducted in 1919, 1921 and 1922. The stand during each of the latter two years was probably less than 50 per cent of normal which accounts for the small amount of pork produced per acre in these trials. The figures for 1919 are therefore more nearly representative of the results which may be expected in this section of the State with an ordinarily good crop of peanuts. The yield of peanuts that year was estimated at 45 bushels per acre. In 1922 the average daily gain per hog was smaller than either of the other years, owing partially to the scarcity of peanurts in the field during the last week of the trial.

Results:

	1919	1921	1922
Date of starting	October 15	September 30	October 6
Area grazed (acres)	2.3	4.75	4.75
Number of hogs used	12.	12.	12.
Length of grazing period (days)	36.	39.5	38.5
Initial weight, total (lbs.)	1389.	1161.	1515.
Average initial weight (lbs.)	115.75	96.7	126.3
Final weight, total (lbs.)	2190.	2050.	2153.
Average final weight (lbs.)	182.5	170.8	179.4
Total gain (lbs.)	801.	889.	638.
Average gain per hog (lbs.)	66.75	74.08	53.2
Average daily gain per hog (lbs.)	1.85	1.88	1.38
Pork produced per acre (lbs.)	347.8	187.16	134.32

Reference: Mississippi Agricultural Experiment Station Bulletin 218, "Grazing and Feeding Trials with Hogs," pages 6 and 7, tables 3 and 4, State College, Mississippi, June 1923.

Another very serious problem confronting many farmers of Mississippi is the low cash income. Under the AAA program the farmers of Mississippi are limited as to the acreage that can be planted to cotton in the different counties to from 20% to 45% of their cultivated land. This limited amount of land devoted to producing cash income fails in many instances to supply enough cash for the necessary expenses for food, clothing, and operating the farm. On farms not requiring all non-cotton land to produce food and feed for the farm, there is a very definite problem of land utilization. This excess acreage should be used to produce cash income. If the economic condition of many farmers in Mississippi is to be improved a higher percentage of the cultivated land must be devoted to producing cash income, which under the present set-up will have to be some enterprise other than cotton. There are several enterprises that might be used for this purpose, including: dairying, poultry, beef cattle, hogs, peanuts. Peanuts is a crop that can be produced over a large portion of the State, and can be used in two ways to supplement the farm income: (1) by producing peanuts and harvesting for market; and (2) by producing the peanuts and harvesting with hogs and in turn market the hogs, which provides some cash and improves the soil at the same time.

There are several sections in the Southern States that are successfully producing peanuts, and peanut-fed hogs. North Carolina, Virginia, Georgia, Texas, and Alabama are the leading states in peanut production and in peanut-fed-hog production.

To determine the part that peanut-fed hogs have in the general farm organization in a peanut section, a study of 24 farms was made in Southeast Alabama. A summary of these 24 farms shows a total of 3663 acres in cultivation. Five hundred and seven acres of this land was planted to harvested peanuts, with an average yield of 1135 pounds of peanuts per acre. Six hundred and eighty-three acres were planted solid in peanuts for hogs, producing an average of 285 pounds of pork per acre. Two hundred and eighty-nine acres were planted a row of corn and a row of peanuts. The peanuts for hogs produced approximately 155 pounds of pork per acre. The number of hogs per farm ranged from 7 to 300 head. Twenty-two and seven tenths percent of the cultivated land was devoted to producing peanuts for pork production. The hogs produced 19.83% of the cash income.

The hogs in this section get but little feed other than peanuts, pasture, and other grazing crops. An average of the 24 farms surveyed show that the brood sow and young pigs get 15 bushels of corn per year per farm in addition to peanuts and other grazing crops. A number of farmers plant fall oats and graze these with their hogs during suitable weather in December, January, February and the first of March. This is followed with soybeans grazed in July and August. Spanish peanuts are grazed the last of August and September. When the Spanish peanuts give way the runner peanuts are ready. In following this system the farmers say that there is but a very little time when hogs do not have enough to eat. According to experiments conducted by the Alabama Experiment Station, the following acreage of crops should be planted per sow: 1 acre oats, 1 acre soybeans, 1 acre Spanish peanuts and 3½ to 4½ acres of runner peanuts, plus pasture. This acreage is suggested as sufficient to furnish feed for the sow and her two litters per year.

Figures 18 and 19 below show hogs being finished for the market on peanuts in Southeast Alabama.

Figure 18—Hogs being finished on peanuts in Southeast Alabama.

Figure 19—Hogs being finished on peanuts in Southeast Alabama.

The brood sow and young pigs are never turned in on fresh ungrazed fields of peanuts. The finishing hogs are turned on the fresh fields and the brood sows and young pigs are used to clean up the scattered nuts, which seems to be enough to keep the brood sow and the young pigs growing very nicely. Too many peanuts available at one time seems to be harmful to young pigs and the brood sow.

"Peanuts are a high-oil, protein-rich feed more concentrated in character than any other known feed. Their concentration compared to the carbonaceous grains is due to the high fat or oil content, which constitutes from 30 to 40 per cent of the weight of the kernel, and to the very low fiber content. The protein content runs from 25 to 30 per cent, depending on the grade. Feeding experiments and analyses indicate that the chief chemical deficiencies of peanuts when considered as a pig feed are concerned with their supply of minerals, especially calcium and common salt, and vitamin A. The quality of the protein appears to be quite superior."*

In considering the above information it should be borne in mind that every farmer who plants peanuts for hogs will not produce 285 pounds of pork per acre. Some may produce more and some less. The amount of pork produced per acre will depend on the management of the young pigs and the yield of peanuts. The more peanuts produced per acre the more pork an acre is capable of producing.

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*From "Pork Production," by William W. Smith, published in 1937.

Bulletin No. 342 April, 1940

Profit From $100 Spent For Cotton Fertilizer

A Summary of Experimental Data On the Effect of Analyses and Rates Of Fertilizer on Profits Obtained In Hill Sections of Mississippi.

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Fertilizer Recommendations for Cotton Production In the Hill Sections of Mississippi

On the basis of the data reported in this bulletin and other available information, the Experiment Station makes the following fertilizer recommendations for cotton:

1. **Limestone uplands:** 200 pounds of sulphate of ammonia and 200 pounds of superphosphate. Clay bottoms in the limestone area need nitrogen only.

2. **Brown loam upland:** 24 pounds of nitrogen, 48 pounds of phosphate, and 24 pounds of potash (600 lbs. 4-8-4 or approximately 1¼ times one of the suggested home-mixtures). Where these soils have been fertilized liberally, the nitrogen should be increased to 36 or 48 pounds per acre.

3. **All other uplands:** 30 to 36 pounds of nitrogen, 36 pounds of phosphate, and 18 pounds of potash. See discussion on soils in South Mississippi (500 lbs. 6-8-4 or 450 lbs. 8-8-4 or one of the suggested home-mixtures with a side dressing of 100 lbs. of nitrate of soda). Where the Longleaf Pine soils have had very little fertilizer, the nitrogen should be reduced to 18 pounds and the potash to 10 pounds per acre.

4. **Silt and sandy loam first and second bottoms:** 24 pounds of nitrogen, 48 pounds of phosphate, and 48 pounds of potash (600 lbs. 4-8-8 or 1¼ to 1½ times one of the suggested home-mixtures with the potash doubled).

5. The above amounts of fertilizer may be reduced, but the ratio should be held constant.

6. Half of the nitrogen should be applied as a side dressing on the light soils.

7. Where fertilizers are home-mixed, the ratio of nitrogen, phosphate, and potash may be varied considerably without affecting the profit materially; provided, a definite amount of money is spent for fertilizers.

8. Fertilizers should be applied long enough before planting time to get a rain so that the seed may be planted on a firm bed.

9. Where half of the nitrogen is used as a side dressing and the remainder of the fertilizer is applied several days in advance of planting, placing the fertilizer to the side of the seed is not necessary.

10. Where large quantities of fertilizer and all of the nitrogen is applied before planting, placing the fertilizer to the side of and below the seed is desirable.

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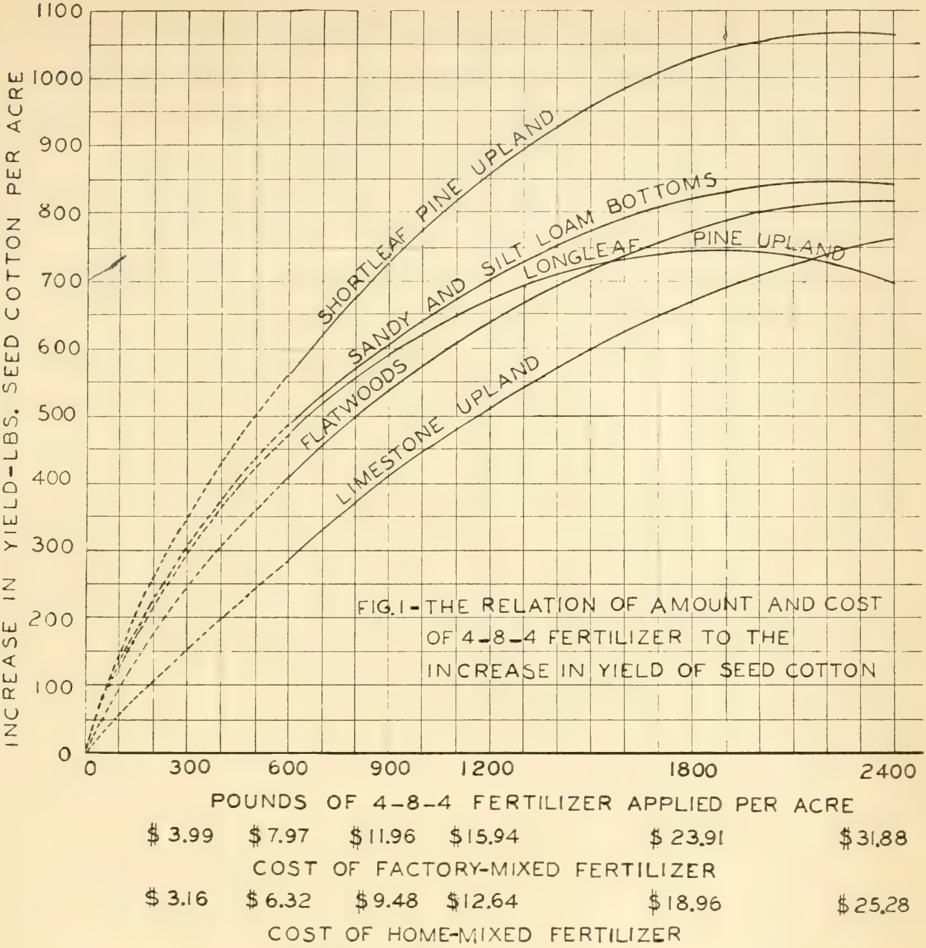


FIG. 1 - THE RELATION OF AMOUNT AND COST OF 4-8-4 FERTILIZER TO THE INCREASE IN YIELD OF SEED COTTON

The average increase in yield of seed cotton obtained from the application of 600, 1,200, 1,800, and 2,400 pounds per acre of 4-8-4 fertilizer on the major soil areas of the State are shown in figure 1.

Twelve hundred pounds per acre of 4-8-4 fertilizer, costing $15.94 when factory mixed and $12.64 when home mixed, was more profitable than 600 pounds or 1,800 pounds, or 2,400 pounds per acre on all soils execpt the Brown loam upland on which 600 pounds was the most profitable rate.

Since the cost of 600 pounds of 4-8-4 was $7.97, and 1,200 pounds of 4-8-4 was usually more profitable than 600 pounds, the recommendation of the use of approximately $8 worth of fertilizer per acre is considered conservative.

The effect of poor growing seasons and low prices on the profits obtained from the use of fertilizers is recognized. In general well drained soils and soils which have a fair supply of lime give better response to fertilizers than poorly drained soils, and soils very low in lime.

Profit From $100 Spent For Cotton Fertilizer

By **W. B. ANDREWS**, Associate Agronomist
Mississippi Experiment Station

Mississippi farmers spent approximately $8,000,000 for commercial fertilizers in 1938; about 60% of the total tonnage was used for cotton production. Each acre of cotton received approximately 10 pounds of nitrogen. The ratio of nitrogen, phosphate (phosphoric acid), and potash in all the fertilizers used varied from a 10-8-6 in Jones County to a 3-8-3 in Attala County. Most of the counties in South Mississippi used ratios varying from 6-8-4 to 10-8-6. In North Mississippi the fertilizers were generally lower in nitrogen.

In Jones County, which uses a large quantity of fertilizer, 74% of the nitrogen was used in home-mixed fertilizer or used alone. In the hill counties less than half of the nitrogen is usually obtained in mixed fertilizers. After good crop years farmers as a whole use good fertilizers, but after poor crop years, fertilizers are often used which are entirely too low in nitrogen.

In 1925 the Mississippi Experiment Station started a series of uniform tests to determine the ratio of nitrogen, phosphate, and potash needed for cotton production in the hill sections of the state. Several of the tests have continued until the present; many of them have been discontinued; and, others of a similar nature have been conducted.

In this bulletin, the averages of the data which can be averaged for the different soil areas of the State are reported. In the past publications the increase in yield and profits per acre have been reported. Most of the tests have been conducted using 600 pounds per acre of the different analysis fertilizers. At the present prices of fertilizers, the cost of 600 pounds of the different analyses used vary from $7.24 to $10.14 when factory-mixed, and from $5.00 to $9.02 when home-mixed. The profits per acre are usually higher with the higher costing fertilizers, and the profit per dollar invested is usually higher with the low costing fertilizers, which makes it difficult to determine which fertilizer would produce the most profit when a definite amount of money was spent for fertilizer.

The purpose of this bulletin is to present the data collected on the increase in yield and profits obtained from $100.00 worth of home-mixed and factory-mixed fertilizer applied at the rate of $7.97 per acre on 12.55 acres regardless of analysis. At the present prices 600 pounds of 4-8-4 costs $7.97. No charge was made for home-mixing, and it may be calculated and subtracted from the profits reported in this bulletin. In addition, the increase in yield and profits for the different analyses are reported. Due to the fact that home-mixed fertilizers are cheaper than factory mixed fertilizers, the $100.00 bought more home-mixed than factory-mixed fertilizers.

Seed cotton was valued at 3½ cents per pound. The costs of factory-mixed fertilizers were as quoted or calculated from quotations. The cost of nitrate of soda was $36.00, superphosphate $22.00, and muriate of potash $41.00 per ton, from which the home-mixed fertilizer costs were calculated. The cost of factory-mixed 4-8-4 was $26.57 per ton, and home-mixed 4-8-4 $21.07 per ton.

Methods of Calculating Profit Obtained From The Use of Fertilizer in Cotton Production

In previous publications, increases in yield and profits per acre from the use of 600 pounds of different analysis fertilizers have been used as a basis of calculating returns from fertilizers. In this bulletin the increase in yield and profits have been calculated for the use of $7.97 per acre of each analysis fertilizer applied to 12.55 acres, which gives $100.00 worth of fertilizer. When the data are presented on this basis the fertilizer which made the most profit per acre also made the most profit per dollar invested in fertilizer.

The data from the Shortleaf Pine Area may be used to illustrate the method of eliminating differences in cost of the fertilizers. $100.00 worth of home-mixed 4-8-4 fertilizer applied at the rate of $7.97 per acre on 12.55 acres produced 8168 pounds of seed cotton. The increase in yield from 600 pounds of home-mixed 4-4-4 costing $5.00 was 564 pounds of seed cotton. From the curve (Figure 1) it is found that $5.00 worth of 4-8-4 fertilizer increased the yield only 484 pounds of seed cotton. Multiplying 8168 by 564 and dividing by 484 gives 9518 pounds of seed cotton produced by $100.00 invested in 4-4-4 fertilizer; $100.00 invested in 4-8-4 produced only 8168 pounds. Multiplying 9518 and 8168 by 3½ cents and subtracting $100.00 gives a profit of $233.13 for 4-4-4, and $185.88 for 4-8-4. The increase in yield and profit for $100.00 invested in each fertilizer was calculated using the curves as illustrated above.

The calculations presented in this bulletin were based on November prices of fertilizer, at which time factory-mixed 4-8-4 fertilizer cost 26% more than home-mixed 4-8-4. The prices of fertilizer and the value of seed cotton vary. If seed cotton is worth more than 3½ cents per pound, there will be more difference between factory and home-mixed fertilizer than the calculations show; if it is worth less than 3½ cents per pound, the difference between them will be less than the calculations show.

With cotton valued at a definite amount, as was done in these studies, where the prices of fertilizer are lower, the profits are higher, and where they are higher, the profits are lower.

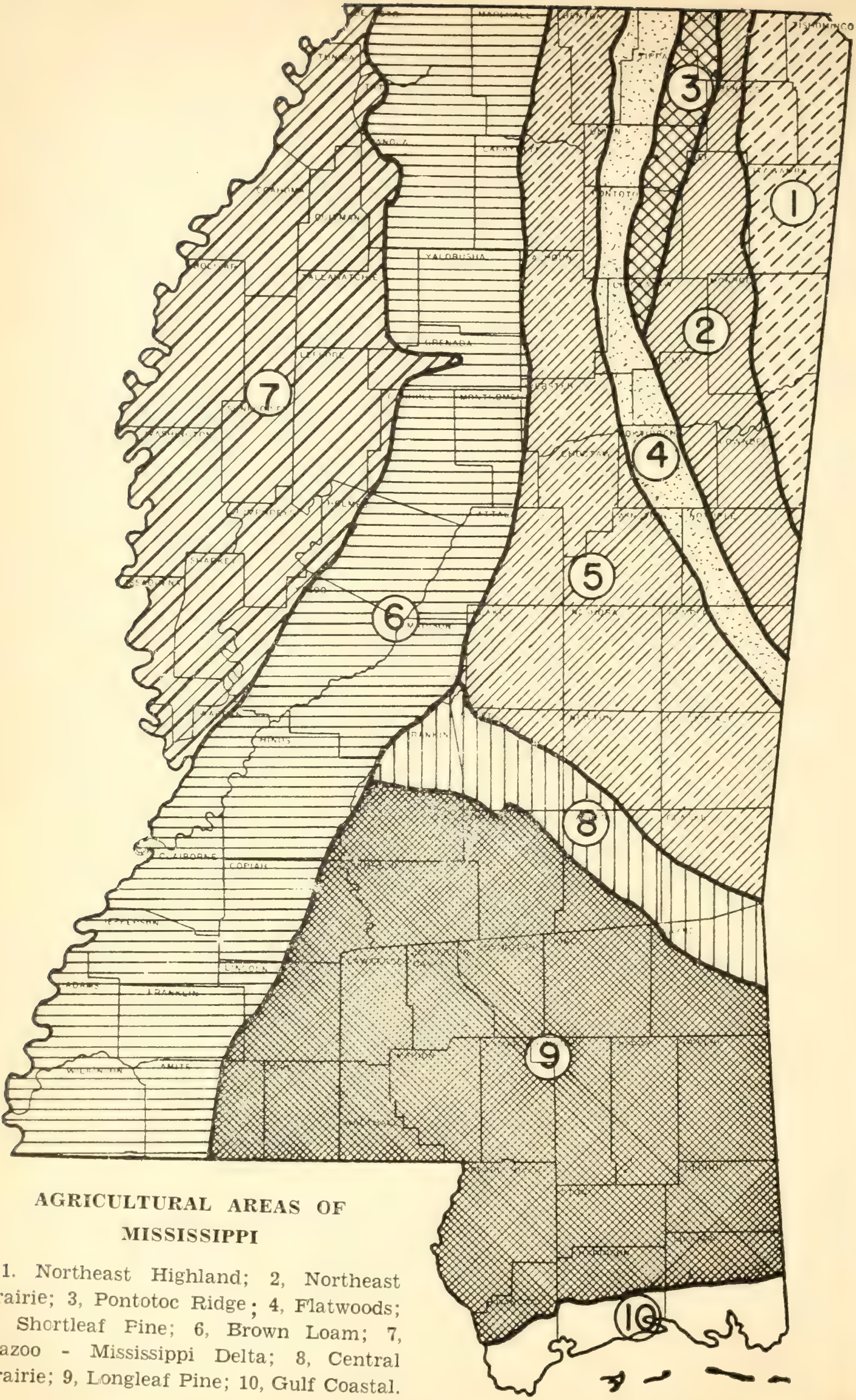
The curves in figure 4 may be used to calculate the increase in yield and profit with the prevailing costs of factory mixed and home mixed 4-8-4 fertilizer, where they differ significantly from the prices used in this bulletin.

The soils in the hill sections of Mississippi on which fertilizer tests have been conducted are grouped as follows: (1) Limestone upland, (2) sandy and silt loam bottom soils throughout the State, (3) Flatwoods Upland, (4) Shortleaf Pine, Post Oak Prairie, Northeast Highland, and Pontotoc Ridge Uplands, (5) Longleaf Pine Upland, and (6) Brown Loam Upland.

The several soils may be located on the map printed herewith.

ACKNOWLEDGMENT

The data reported in this bulletin were collected by the different men connected with the Agronomy Department and the Branch Stations in the hill sections of the State since 1925. The information concerning the usage of fertilizers in Mississippi was taken from a thesis by P. H Grissom. The fertilizer placement discussion was based on data obtained throughout the Cotton Belt.


TISHOMINGO
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RANKIN
8
CLAIBORNE
COPIAH
JEFFERSON
LINCOLN
ADAMS
FRANKLIN
WILKINSON
AMITE
9
10

AGRICULTURAL AREAS OF MISSISSIPPI

1. Northeast Highland; 2, Northeast Prairie; 3, Pontotoc Ridge; 4, Flatwoods; 5, Shortleaf Pine; 6, Brown Loam; 7, Yazoo - Mississippi Delta; 8, Central Prairie; 9, Longleaf Pine; 10, Gulf Coastal.

Response of Cotton to Different Analyses and Rates Of Fertilizer in the Hill Sections of Mississippi

Limestone Upland

The data in table 1 on the limestone upland soils show that these soils do not need potash. Each addition of potash resulted in a decrease in profits; each increase in phosphate over 4% decreased the profit; each increase in nitrogen increased the profit with factory-mixed fertilizers. With factory-mixed fertilizers $100.00 worth of 8-8-4 produced a profit of $86.87, and 6-8-4 produced a profit of $73.46. With home-mixed fertilizers $100.00 of 8-8-4 produced a profit of $109.02 or $22.15 more than the same amount of money invested in factory-mixed 8-8-4.

The above data indicate that the most profitable fertilizer ratio to use on these soils is an 8-8-0, which is borne out by the data in table 2. The small increase for potash is considered insignificant since it did not increase the yield in the other tests. The most profitable ratio in the test was an 8-8-0 which produced a profit of $48.26 on $100.00 invested in factory-mixed fertilizer and $70.42 per $100.00 invested in home-mixed fertilizer.

Only one test has been conducted on limestone valley land. In this test nitrogen was highly profitable, while a small response was obtained from an 8-4-0 over nitrogen alone.

Since these soils have an abundant supply of lime, acid-forming fertilizers should be used, due to the fact that they are cheaper and just as good or better than neutral fertilizers. The data indicate that 200 pounds of sulphate of ammonia and 200 pounds of superphosphate per acre will return an average profit of more than $70.00 per $100.00 spent for fertilizers. Nitrate of soda was the source of nitrogen used in the above home-mixed fertilizers. Since sulphate of ammonia would be expected to be as good as or better than nitrate of soda on these soils, the cost of the same fer-

TABLE 1—THE EFFECT OF ANALYSES AND RATES OF FERTILIZERS ON THE YIELD OF SEED COTTON AND PROFITS ON LIMESTONE UPLAND SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying potash									
600 lbs. 4-8-0	7.21	5.34	297	3.19	5.06	3997	5324	39.90	86.34
600 lbs. 4-8-2	7.59	5.80	311	3.30	5.09	4032	5194	41.12	81.79
600 lbs. 4-8-4	7.97	6.32	281	1.87	3.52	3526	4392	23.41	53.72
600 lbs. 4-8-6	8.34	6.82	274	1.25	2.77	3253	3933	13.86	37.66
600 lbs. 4-8-8	8.72	7.31	299	1.75	3.16	3423	4041	19.81	41.44
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	329	4.28	6.52	4428	6282	54.98	119.87
600 lbs. 4-6-4	7.60	5.66	337	4.23	6.14	4353	5759	52.86	101.57
600 lbs. 4-8-4	7.97	6.32	281	1.87	3.52	3526	4392	23.41	53.72
Varying Nitrogen									
600 lbs 4-8-4	7.97	6.32	281	1.87	3.52	3526	4392	23.41	53.72
600 lbs. 6-8-4	9.05	7.67	447	6.60	7.98	4956	5724	73.46	100.34
600 lbs. 8-8-4	10.14	9.02	533	8.52	9.64	5339	5972	86.87	109.02
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	281	1.87	3.52	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	528	2.54	5.84	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	654	—1.02	3.93	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	767	—5.03	1.57	....	....	....	....
Yield without fertilizer			571	....	....	....	....	....	....

TABLE 2—THE EFFECT OF ANALYSES AND RATES OF FERTILIZERS ON THE YIELD OF SEED COTTON AND PROFITS ON LIMESTONE SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 8-4-0	8.75	6.72	318	2.38	4.41	3702	4581	29.57	60.34
600 lbs. 8-4-4	9.51	7.70	369	3.41	5.22	3983	4722	39.41	65.27
Varying Phosphorus Without Potash									
600 lbs. 8-0-0	......	5.40	—9	......	......	....	....	....	....
600 lbs. 8-4-0	8.75	6.72	318	2.38	4.41	3702	4581	29.57	60.34
600 lbs. 8-8-0	9.38	8.04	389	4.24	5.58	4236	4869	48.26	70.42
Varying Phosphorus With Potash									
600 lbs. 8-0-4	8.88	6.38	78	—6.15	—3.65	889	1160	—68.88	—59.40
600 lbs. 8-4-4	9.51	7.70	369	3.41	5.22	3983	4722	39.41	65.27
600 lbs. 8-8-4	10.14	9.02	391	3.55	4.67	4021	4434	40.74	55.19
Rates of 8-8-0									
300 lbs. 8-8-0	4.69	4.02	185	1.79	2.46	....	....	....	....
600 lbs. 8-8-0	9.38	8.04	389	4.24	5.58	....	....	....	....
900 lbs. 8-8-0	14.07	12.06	470	2.38	4.39	....	....	....	....

tilizer would be reduced from $100.00 to $86.57. Where nitrate of soda was used as the source of nitrogen, $22.16 more money was made on $100.00 worth of home-mixed than on $100.00 worth of factory-mixed fertilizer. Combining these two profits gives a total profit of about $35.00 per $100.00 invested in the sulphate of ammonia and superphosphate mixture over $100.00 invested in factory-mixed 8-8-0.

The "red prairie" or "post oak" soils respond to a complete fertilizer similar to the Shortleaf Pine soils.

TABLE 3—THE EFFECT OF ANALYSES AND RATES OF FERTILIZERS ON THE YIELD OF SEED COTTON AND PROFITS ON SANDY AND SILT LOAM BOTTOM LAND SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 4-8-0	7.21	5.34	162	—1.54	0.33	2126	2558	—25.59	—10.47
600 lbs. 4-8-2	7.59	5.80	357	4.91	6.70	4546	5391	59.11	88.69
600 lbs. 4-8-4	7.97	6.32	477	8.73	10.38	5985	6901	109.48	141.54
600 lbs. 4-8-6	8.34	6.82	532	10.28	11.80	6432	7199	125.12	151.97
600 lbs. 4-8-8	8.72	7.31	587	11.83	13.24	6862	7716	140.17	170.06
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	400	6.76	9.00	5262	6636	84.17	132.26
600 lbs. 4-6-4	7.60	5.66	462	8.57	10.51	5883	7023	105.91	145.81
600 lbs. 4-8-4	7.97	6.32	477	8.73	10.38	5985	6901	109.48	141.54
Varying Nitrogen									
600 lbs. 4-8-4	7.97	6.32	477	8.73	10.38	5985	6901	109.48	141.54
600 lbs. 6-8-4	9.05	7.67	499	8.42	9.80	5732	6377	100.62	133.20
600 lbs. 8-8-4	10.14	9.02	484	6.80	7.92	5038	5642	76.33	97.47
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	477	8.73	10.38	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	725	9.44	12.74	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	798	4.02	8.97	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	848	—2.20	4.40	....	....	....	....
Yield without fertilizer			829	......	......	....	....	....	....

Sandy Loam and Silt Loam Bottom Soils

The sandy loam and silt loam bottom soils throughout the State usually have more available water than the upland soils around them. The higher water content causes the temperature to be lower, and the aeration is less. As a result, the organic matter does not decompose as rapidly, and the soils have a higher nitrogen content than the upland soils.

The lowest ratio of nitrogen used on these soils was 4% (table 3). Increasing the nitrogen above 4% was not profitable. The increase in yield from 4-8-0 was not sufficient to pay for the fertilizer. Increasing the potash from 0 to 2%, 4%, 6% and 8% was profitable in every case. Increasing the phosphate from 4% to 6% was highly profitable. The most profitable ratio was a 4-8-8, which made a profit of $140.17 per $100.00 invested in factory-mixed fertilizer, and $170.06 per $100.00 invested in home-mixed fertilizer. There was a difference of $29.89 more profit per $100.00 spent for home-mixed fertilizers over factory-mixed fertilizers.

Flatwoods Uplands

The Flatwoods soils are usually very poorly drained. The internal drainage is so poor that water moves down through them very slowly. The level Flatwoods soils are very uncertain and crop failures on them occur frequently. The soils which have good surface drainage are fairly productive.

The data in table 4 show that each increase of potash increased the yield, and the profit per acre was increased in every case where 600 pounds of the different fertilizers were used. Where the data were calculated to $100.00 worth of each fertilizer applied to 12.55 acres, the profits for factory-mixed fertilizers increased with each increase of potash except from 4% to 6%. Where $100.00 was spent for home-mixed fertilizers, 2% and 6% potash were no more profitable than no potash. The mixtures containing 4% and 8% potash were only slightly more profitable than no potash.

Increasing the phosphate from 4% to 6% increased the profits for $100.00 worth of factory-mixed fertilizer from

TABLE 4—THE EFFECT OF ANALYSES AND RATES OF FERTILIZERS ON THE YIELD OF SEED COTTON AND PROFITS ON FLATWOODS UPLAND SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 4-8-0	7.21	5.34	354	5.18	7.05	4662	5866	63.17	105.31
600 lbs. 4-8-2	7.59	5.80	374	5.50	7.29	4764	5860	66.74	105.10
600 lbs. 4-8-4	7.97	6.32	401	6.07	7.72	5031	6048	76.09	111.68
600 lbs. 4-8-6	8.34	6.82	417	6.26	7.78	4948	5798	73.18	102.93
600 lbs. 4-8-8	8 72	7.31	457	7.28	8.69	5249	6115	83.72	114.03
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	325	4.14	6.38	4247	5616	48.65	96.56
600 lbs. 4-6-4	7.60	5.66	383	5.81	7.75	4854	6080	69.89	112.80
600 lbs. 4-8-4	7.97	6.32	401	6.07	7.72	5031	6048	76.09	111.68
Varying Nitrogen									
600 lbs 4-8-4	7.97	6.32	401	6.07	7.72	5031	6048	76.09	111.68
600 lbs. 6-8-4	9.05	7.67	480	7.75	9.13	5390	6177	88.65	116.20
600 lbs. 8-8-4	10.14	9.02	576	10.02	11.14	6000	6686	110.00	134.01
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	401	6.07	7.72	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	662	7.23	10.53	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	748	2.27	7.22	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	828	—2.90	3.70	....	....	....	....

$48.65 to $69.89, and for $100.00 worth of home-mixed fertilizer from $96.56 to $112.80. Increasing the phosphate from 6% to 8% increased the profits slightly with factory-mixed fertilizer but not with home-mixed fertilizer.

The best ratio in the test was an 8-8-4. When factory-mixed $100.00 worth of 8-8-4 made a profit of $110.00, and $134.01 when home-mixed.

Shortleaf Pine Upland

The soils of the Pontotoc Ridge, Post Oak, prairie, and Northeast Highland respond to fertilizer treatment similar to the Shortleaf Pine soils. The soils of these areas are usually unproductive unless fertilizers are used, and they give greater response to fertilizer than most of the other upland soils in the State.

The increases in yield of seed cotton where 0, 2%, 4%, 6%, and 8% potash was applied were 493, 549, 561, 586, and 567 pounds per acre, respectively (table 5). The profit per acre was increased $1.58, and $1.50 for 2% potash in factory-mixed and home-mixed fertilizers respectively. Where $100.00 was spent for factory-mixed fertilizers, a 4-8-2 was more profitable than a 4-8-0, and it was just as profitable as 4-8-4, 4-8-6, and 4-8-8. With home-mixed fertilizers, a 4-8-2 was more profitable than a 4-8-0, 4-8-4, 4-8-6, or a 4-8-8.

Increasing the phosphate from 4% to 6% increased the yield slightly, but no more cotton was produced with a 4-8-4 than with a 4-4-4. Where $100.00 was spent for factory-mixed fertilizers, a 4-4-4 was equally as profitable as a 4-6-4 and more profitable than a 4-8-4. Where the fertilizers were home-mixed, $100.00 invested in 4-4-4, 4-6-4, and 4-8-4 made profits of $233.13, $215.70, and $185.88. Where 4%, 6%, and 8% nitrogen was applied the yields were increased 561, 747, and 774 pounds of seed cotton per acre, respectively. On a per acre basis, a 6-8-4 was more profitable than a 4-8-4 and just as profitable as an 8-8-4. With $100.00 invested in 6-8-4 fertilizers, the profit was $200.72 where factory-mixed, and $236.32 where home-mixed. Home-mixing this fertilizer increased the income $35.62. The home-

TABLE 5—THE EFFECT OF ANALYSES AND RATES OF FERTILIZERS ON THE YIELD OF SEED COTTON AND PROFITS ON SHORTLEAF PINE SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 4-8-0	7.21	5.34	493	10.05	11.92	6548	7974	129.18	179.09
600 lbs. 4-8-2	7.59	5.80	549	11.63	13.42	7026	8413	145.91	194.46
600 lbs. 4-8-4	7.97	6.32	561	11.67	13.32	7039	8168	146.37	185.88
600 lbs. 4-8-6	8.34	6.82	586	12.17	13.69	7051	8058	146.79	182.03
600 lbs. 4-8-8	8.72	7.31	567	11.13	12.54	6652	7530	132.82	163.55
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	564	12.50	14.74	7491	9518	162.19	233.13
600 lbs. 4-6-4	7.60	5.66	582	12.77	14.71	7476	9020	161.66	215.70
600 lbs. 4-8-4	7.97	6.32	561	11.67	13.32	7039	8168	146.37	185.88
Varying Nitrogen									
600 lbs. 4-8-4	7.97	6.32	561	11.67	13.32	7039	8168	146.37	185.88
600 lbs. 6-8-4	9.05	7.67	747	17.10	18.48	8592	9609	200.72	236.32
600 lbs. 8-8-4	10.14	9.02	774	16.95	18.07	8217	8942	187.60	212.97
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	561	11.67	13.32	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	861	14.20	17.50	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	1024	11.93	16.88	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	1067	5.47	12.07	....	....	....	....
Yield without fertilizer	....	....	471	....	....	....	....	....	....

TABLE 6—THE EFFECT OF ANALYSES AND RATES OF FERTILIZERS ON THE YIELD OF SEED COTTON AND PROFITS ON LONGLEAF PINE SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 4-8-0	7.21	5.34	414	7.28	9.15	5400	6553	89.00	129.36
600 lbs. 4-8-2	7.59	5.80	492	9.63	11.42	6266	7407	119.31	159.25
600 lbs. 4-8-4	7.97	6.32	472	8.55	10.20	5922	6775	107.27	137.13
600 lbs. 4-8-6	8.34	6.82	473	8.22	9.74	5717	6435	100.10	125.23
600 lbs. 4-8-8	8.72	7.31	407	5.53	6.94	4801	5365	68.04	87.78
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	387	6.31	8.55	5037	6303	76.30	120.61
600 lbs. 4-6-4	7.60	5.66	414	6.89	8.83	5261	6317	84.14	121.10
600 lbs. 4-8-4	7.97	6.32	472	8.55	10.20	5922	6775	107.27	137.13
Varying Nitrogen									
600 lbs. 4-8-4	7.97	6.32	472	8.55	10.20	5922	6775	107.27	137.13
600 lbs. 6-8-4	9.05	7.67	484	7.89	9.27	5620	6187	96.70	116.55
600 lbs. 8-8-4	10.14	9.02	539	8.73	9.85	5889	6351	106.12	122.29
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	472	8.55	10.20	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	686	8.07	11.37	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	730	1.64	6.59	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	704	—7.24	—0.64	....	....	....	....
Yield without fertilizer			670	......	......	....	....	....	....

mixed 4-4-4 made a profit of $233.13 which is practically the same as that for 6-8-4.

Longleaf Pine Uplands

Where 600 pounds per acre of a 4-8-0 fertilizer was used, the increase in yield was 414 pounds of seed cotton, and a 4-8-2 produced an increase of 492 pounds of seed cotton. Increasing the potash from 2% to 4%, to 6% or 8% resulted in decreases in yield as compared with 4-8-2 (table 6). The best analysis was a 4-8-2 which made a profit of $119.31 when factory-mixed, and $159.25 when home-mixed per $100.00 invested in fertilizers. The home-mixed fertilizer made a profit of $39.94 more per $100.00 invested in fertilizers than did the factory-mixed fertilizer. The data presented in table 6 are an average of four tests for a total of 13 years which should make them indicative.

Increasing the phosphate from 4% to 6% and 8% produced increases in yield, and the profits for $100.00 worth of factory-mixed fertilizer were 4-4-4, $76.30; 4-6-4, $84 14; and 4-8-4, $107.27; and for home-mixed fertilizers, 4-4-4, $120.61; 4-6-4, $101.10; and 4-8-4, $137.13.

The increases due to nitrogen applied above 4% were too small to pay the cost.

The ratio of the total nitrogen, phosphate, and potash used in the most of the counties in South Mississippi in 1938 varied from a 6-8-4 to a 10-8-6. In these counties usually considerably more than half of the nitrogen is bought as unmixed nitrogen fertilizer, and as a result quite a lot of nitrogen is used as a side dressing. Since phosphate accumulates in the soil, the use of phosphatic fertilizers over a long period of time should reduce the phosphate required in the fertilizer, and the ratio of nitrogen and potash to phosphate should increase as it has done in this section of the State. This change has been amply borne out by long time tests. Where little fertilizer has been used, a 4-8-2 ratio is probably best, but where the land has been fertilized liberally for several years, a 6-8-4 or 8-8-4 will probably be most profitable for these soils.

Brown Loam Upland

The increases in yield from the different rates of 4-8-4 fertilizers could not be used to plot a curve similar to those in figure 1; consequently the calculations on increases in yield and profits per $100 invested in the different fertilizers applied to 12.55 acres could not be made.

The addition of 2% and 4% potash increased the yield (table 7) of seed cotton from 361 to 475 and to 577 pounds of seed cotton per acre, respectively. The use of higher quantities of potash reduced the yield. In the latter respect these soils responded similarly to the Longleaf Pine soils.

The Brown Loam soils were very responsive to the higher quantities of phosphate. The increases in yield obtained with 4-4-4, 4-6-4, and 4-8-4 were 360, 400, and 577 pounds of seed cotton per acre, respectively. The use of higher quantities of nitrogen were not profitable.

The best ratio for cotton production on these soils was a 4-8-4 which produced a profit of $12.23 per acre when factory-mixed and $13.88 when home-mixed.

On the basis of the costs of the fertilizers used in this bulletin, it will take $126.30 worth of factory-mixed 4-8-4 to be equal to $100.00 worth of home-mixed 4-8-4.

The upland soils of the Brown Loam Area as a whole have received very little fertilizer, and on the basis of the data presented the majority of these soils will probably give the best response to a 4-8-4 fertilizer. In one test at Holly Springs which has been conducted for 14 years, during the first several years of the test, 600 pounds of 4-8-4 fertilizer actually produced more cotton than did 600 pounds of 8-8-4, but in recent years the 8-8-4 has been considerably more profitable. From these data it appears that a 4-8-4 fertilizer should be the most profitable fertilizer to use on these soils where little fertilizer has been used, and that an 8-8-4 fertilizer should be used where the soil has been fertilized liberally for several years.

TABLE 7—THE EFFECT OF ANALYSES AND RATES OF FERTILIZER ON THE YIELD OF SEED COTTON AND PROFITS ON BROWN LOAM UPLAND SOILS

Analysis and Rate Per Acre	Cost of Fertilizer		Increase in Yield Per Acre	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
	Factory Mixed	Home Mixed		Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 4-8-0	7.21	5.34	361	5.43	7.30	....	....	....	....
600 lbs. 4-8-2	7.59	5.80	475	9.04	10.83	....	....	....	....
600 lbs. 4-8-4	7.97	6.32	577	12.23	13.88	....	....	....	....
600 lbs. 4-8-6	8.34	6.82	511	9.55	11.07	....	....	....	....
600 lbs. 4-8-8	8.72	7.31	498	8.71	10.12	....	....	....	....
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	360	5.36	7.60	....	....	....	....
600 lbs. 4-6-4	7.60	5.66	400	6.40	8.34	....	....	....	....
600 lbs. 4-8-4	7.97	6.32	577	12.23	13.88	....	....	....	....
Varying Nitrogen									
600 lbs. 4-8-4	7.97	6.32	577	12.23	13.88	....	....	....	....
600 lbs. 6-8-4	9.05	7.67	491	8.14	9.52	....	....	....	....
600 lbs. 8-8-4	10.14	9.02	564	9.60	10.72	....	....	....	....
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	577	12.23	13.88	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	618	5.69	8.99	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	746	2.20	7.15	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	833	—2.72	3.88	....	....	....	....
Yield without fertilizer			618	......	......	....	....	....	....

Similarity of the Upland Data

The best analysis in the Flatwoods was an 8-8-4; the best analysis in the Shortleaf Pine Area was a 6-8-4 (with home-mixed fertilizers a 4-4-4 was just as good as a 6-8-4, and the 4-8-2 was as good as or better than a 4-8-4); the best analysis in the Longleaf Pine Area was a 4-8-2. These data indicate that the nitrogen should be twice as high as the potash on these soils as a whole.

Where the Brown Loam and Longleaf Pine soils have been fertilized liberally for several years, they will give better response to a 6-8-4 or an 8-8-4 than to the 4-8-4 and 4-8-2. It appears that the nitrogen content of the fertilizers will increase as time goes on and it may go higher than could be anticipated at the present time. The Limestone Upland soils were very responsive to phosphorus and no potash was required; the best analysis for these soils was an 8-3-0.

Soils Requiring Lime, Additional Potash

On many of the sandy soils which are strongly acid, often after a good stand of cotton comes up, it starts dying and continues to die until frost. The use of lime on one of these soils almost completely prevented the premature dying of cotton, and the stand was maintained until frost.

On the unlimed soil the stand died out very badly. Where this condition exists, it is recommended that mixed fertilizers which are made neutral with dolomite be used, or that dolomite or lime be used in the home-mixed fertilizer.

Where cotton rusts badly, the leaves drop off before maturity, and the bolls fail to open properly, more potash is needed than is generally recommended for the upland soils of the State. In these cases the potash may be profitably doubled in the fertilizer generally recommended.

TABLE 8—THE EFFECT OF ANALYSES AND RATES OF FERTILIZER ON THE YIELD OF SEED COTTON AND PROFITS ON AVERAGE SHORTLEAF PINE, LONGLEAF PINE, AND FLATWOODS UPLAND SOILS

Analysis and	Cost of Fertilizer		Increase in	Profit per Acre		$100.00 Invested in Fertilizers Applied at $7.97 Per Acre on 12.55 Acres			
						Increase In Yield		Profit	
Rate Per Acre	Factory Mixed	Home Mixed	Yield Per Acre	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed	Factory Mixed	Home Mixed
Varying Potash									
600 lbs. 4-8-0	7.21	5.34	420	7.49	9.36	5572	6735	95.02	135.73
600 lbs. 4-8-2	7.59	5.80	472	8.93	10.72	6048	7205	111.68	152.18
600 lbs. 4-8-4	7.97	6.32	478	8.76	10.41	5997	6976	109.90	144.16
600 lbs. 4-8-6	8.34	6.82	492	8.88	10.40	5961	6770	108.64	136.95
600 lbs. 4-8-8	8.72	7.31	477	7.98	9.39	5598	6326	95.93	121.41
Varying Phosphorus									
600 lbs. 4-4-4	7.24	5.00	425	7.64	9.88	5602	7231	96.07	153.09
600 lbs. 4-6-4	7.60	5.66	460	8.50	10.44	5894	7131	106.29	149.59
600 lbs. 4-8-4	7.97	6.32	478	8.76	10.41	5997	6976	109.90	144.16
Varying Nitrogen									
600 lbs. 4-8-4	7.97	6.32	478	8.76	10.41	5997	6976	109.90	144.16
600 lbs. 6-8-4	9.05	7.67	570	10.90	12.28	6548	7309	129.18	155.82
600 lbs. 8-8-4	10.14	9.02	630	11.91	13.03	6747	7300	136.15	155.50
Rates of 4-8-4									
600 lbs. 4-8-4	7.97	6.32	478	8.76	10.41	....	....	....	....
1200 lbs. 4-8-4	15.94	12.64	736	9.82	13.12	....	....	....	....
1800 lbs. 4-8-4	23.91	18.96	834	5.28	10.23	....	....	....	....
2400 lbs. 4-8-4	31.88	25.28	866	—1.57	5.03	....	....	....	....
Yield without fertilizer			490	....	....	....	....	....	....

Calculating the Increase in Yield for 300 Pounds From Data Where 600 Pounds of Fertilizer Was Used

Most of the data on fertilizer analyses reported by the Experiment Station have been conducted using 600 pounds per acre; most of the rates have been 600, 1200, 1800, and 2400 pounds per acre. There have been a few tests conducted using 300 and 600 pounds per acre of 6-8-4 and 8-8-0. The data on the actual increases in yield and the relative increases in yield taking 600 pounds as 100 are reported in table 9.

Where the increase in yield for 600 pounds of 6-8-4 is taken as 100%, 300 pounds of 6-8-4 increased the yield 60%, 62%, 64%, 63% in the Flatwoods, Northeast Highland, and two Shortleaf Pine tests, respectively. The average increase in yield for 300 pounds of 6-8-4 was 62% of the increase for 600 pounds of 6-8-4.

On the Post Oak soils, 300 pounds of 6-8-4 made 53% as much as 600 pounds. On the Limestone uplands and bottom soils the increase in yield from 300 pounds of 8-8-0 was 54% and 57% respectively of the increase in yield from 600 pounds of 8-8-0.

Where data are available on the increase in yield for 600 pounds per acre of fertilizer, the increase in yield for 300 pounds may be estimated rather accurately by the use of the above relative yields.

TABLE 9—THE RESPONSE OF COTTON TO RATES OF FERTILIZER

Lbs. of		Northeast	Shortleaf Pine*		Northeast Prairie		
Fertilizer Per Acre	Flatwood's* (4 years)	Highland* (4 years)	No. 1 (3 years)	No. 2 (1 year)	Post Oak* (2 years)	Limestone upland** (4 years)	Limestone valley** (4 years)
			Increase in yield, pounds seed cotton per acre				
300	399	422	262	279	218	215	181
600	669	711	411	441	410	380	337
			Relative increase in yield				
300	60	62	64	63	53	57	54
600	100	100	100	100	100	100	100
Yield without fertilizer	180	290	548	537	343	499	520

*The analysis was 6-8-4.

**The analysis was 8-8-0.

A Definite Amount of Money Spent for Fertilizer Will Return More Profit When Home Mixed

The data in the tables on the average profits from home-mixed fertilizers, for the Flatwoods, Shortleaf Pine, and Longleaf Pine soil areas show that when $100.00 was spent for fertilizer a 4-8-2, 4-4-4, 4-6-4, 6-8-4, and 8-8-4 were almost equally profitable (table 8). The data show when mixed fertilizers are used that a rather definite ratio (usually a 6-8-4 or 8-8-4) is most profitable, but when home-mixing is practiced, a definite ratio is not nearly so essential.

Home-mixing offers an advantage in that the nitrogen, phosphorus, and potash can be varied for each field. In general, the bottom lands need less nitrogen and more potash than the uplands. The sandy soils usually need more potash than the heavy soils.

Home-Mixed Fertilizers

The fertilizers used for home-mixing in these tests were: nitrate of soda, superphosphate, and muriate of potash. In the calculations on factory-mixed fertilizers, it has been assumed that the factory-mixed fertilizers are as good pound for pound as the home-mixed fertilizer. The factory-mixed fertilizer should be as good pound for pound as the home-mixed fertilizer; provided, the factory-mixed fertilizers are made neutral with dolomite. They will not be as good if they are acid-forming except on the Limestone soils where acid-forming fertilizers should be used.

The expenditure of $100.00 for factory-mixed 4-8-4 in the Shortleaf Pine Area produced 7039 pounds of seed cotton having a value of $246.37 at 3½ cents per pound. Subtracting $100.00 gives a profit of $146.37. The same amount of home-mixed fertilizer would have cost $79.18, or $100.00 worth of home-mixed 4-8-4 would cost $126.30 when factory-mixed. Subtracting $79.18 from $246.37 gives a profit of $167.19. Where $100.00 worth of home-mixed 4-8-4 was applied, the profit was $185.88. Subtracting $167.19 from $185.88 gives $18.69 profit made on the additional $20.82 worth of fertilizer obtained from $100.00 spent for home-mixed 4-8-4 instead of factory-mixed 4-8-4.

The importance of home-mixing fertilizers and the use of nitrogen fertilizers alone in the hill sections of Mississippi is shown by the amount of nitrogen fertilizers bought. From 1930 to 1938 by years 61%, 49%, 54%, 45%, 45%, 54%, 58%, 54%, and 52%, respectively, of the total nitrogen bought was in nitrogen fertilizers. Usually less than half of the nitrogen bought was in mixed fertilizers.

Home-Mixing Fertilizers

Fertilizers can be mixed thoroughly by putting the fertilizers to be mixed in a pile and then shoveling over to a new pile putting each shovel full of fertilizer on top of the new pile. Three such shovelings should be sufficient. Fertilizers may be mixed in a wagon bed, on a tight floor, or preferably on hard ground. When mixing is done on hard ground, there is sufficient room and a little soil in the fertilizer does not matter.

The following fertilizer combinations will approach a 3-8-4 or a 4-8-4 fertilizer ratio, and the use of these fertilizers makes it necessary to use the same amount of nitrogen as a side dressing.

Home Mixture I

100 lbs. nitrate of soda
200 lbs. superphosphate (18%)
40 lbs. (2/5 sack) muriate of potash

Home Mixture II

100 lbs. sulphate of ammonia
300 lbs. dolomite
200 lbs. 20% superphosphate
40 lbs. (2/5 sack) muriate of potash

Home Mixture III

100 lbs. sulphate of ammonia
600 lbs. basic slag
40 lbs. (2/5 sack) muriate of potash

Where basic slag and sulphate of ammonia are mixed, a small amount of ammonia is given off which is very disagreeable if the mixing is done in a tight building. If the mixing is done in the open air and the fertilizer is applied immediately, the loss of ammonia and the disagreeableness should be negligible. Basic slag and sulphate of ammonia may be mixed on dry hard ground, but they should not be mixed on moist ground.

When the sulphate of ammonia is damp, 100 pounds of superphosphate should be used instead of 200 pounds of basic slag. The sulphate of ammonia and superphosphate should be mixed before adding the rest of the basic slag.

Home Mixture IV

100 lbs. calnitro
200 lbs. superphosphate (18%)
40 lbs. (2/5 sack) muriate of potash

Home Mixture V

100 lbs. calcium nitrate
200 lbs. superphosphate (18%)
40 lbs. muriate of potash (2/5 sack)

Calnitro and calcium nitrate take up water readily and when they are used, the mixture should be applied immediately. Where a 4-8-2 fertilizer is desired, the potash should be cut in half in the above home mixtures.

Rate of Fertilizer Application and the Soil Determine the Methods of Application

Bedding land long enough before planting time to get a rain produces a firm seed bed which usually results in higher yields. The higher yields are due to quicker germination and better stands. When cotton is planted on a firm seed bed, the seed are in closer contact with the soil moisture.

Very satisfactory results are usually obtained when the fertilizers are applied and bedded on long enough before planting to get a rain. When fertilizers are applied immediately before planting, usually no harmful results are obtained with 300 to 400 pounds of fertilizer per acre, but when approximately 600 pounds of a 6-8-4 or similar fertilizer is applied, the concentration of the fertilizer under the seed may cause delayed germination and reduced stands. Injury from placing the fertilizer too close to the seed is worse on sandy soils than on clay soils. Where a large quantity of complete fertilizer is applied immediately before planting, it should be put in a furrow made in the list furrow to place the fertilizer 2½ inches to the side and 2½ inches below the seed.

Where large amounts of fertilizer are bedded on immediately before planting less injury to the stand results when half of the nitrogen is applied under the cotton and half of it is applied as a side dressing. On the lighter soils nitrogen leaches badly when heavy rains come, and as a result higher yields are usually obtained when half of the nitrogen is applied as a side dressing. On the heavy soils applying all of the nitrogen under the cotton is just as satisfactory as applying part of it under the cotton and part of it as a side dressing. When cotton is to be side dressed, the nitrogen should be applied as soon as it has been worked out.

It is generally believed that applying all of the nitrogen under cotton causes the grass to grow faster, which may be another argument in favor of side dressing with part of the nitrogen.

Generally, all of the phosphate and potash should be applied before planting. Where an extreme potash deficiency occurs, and no potash was applied before planting, side dressing with potash may prove profitable.

All Soils Need Nitrogen, but Many Do Not Need the Recommended Quantity of Phosphate and Potash

All Soils Do Not Need Phosphorus and Potash

The data presented in this paper, upon which the general fertilizer recommendations for the hill sections of the State are based, were collected upon soils which are considered to respond to fertilizers like the majority of the soils. However, there are other data available which show that (1) all soils do not need phosphate, (2) all soils do not need potash, and (3) a few soils need more potash than is generally recommended

There are variations in the needs of cotton for potash and phosphate, and these variations may occur on one farm. Where cotton has been liberally fertilized with fertilizers containing a high amount of phosphate, this fertilizer may accumulate in the soil and the need for it is reduced. Nitrogen does not accumulate except in the heaviest and most poorly drained soils, and not to any great extent on these. Potash may accumulate in the heavy soils, but very little will accumulate on the lightest soils.

Changes in the amount of potash used may be made with a fair degree of accuracy on the appearance of the cotton and on the soil. In general clay soils have a good supply of potash and sandy soils have a low supply Where cotton shows little tendency to rust or die prematurely, less potash may be used, and where it rusts badly, dies prematurely, and the bolls fail to open properly, more potash may be necessary.

Where fertilizers are used solely on the basis of recommendations, the recommendations made in this bulletin will probably be the safest to follow, but it is recognized that a farmer can more exactly adapt the recommendations by studying cotton on his soil and conducting simple tests. The farmer who makes these studies should make substantial savings and profits through the use of better fertilizers.

Where fertilizers are home-mixed, the need for phosphate and potash may be determined by leaving one of these out of the fertilizer on a small area. The need of cotton for the fertilizer left out may be determined rather accurately by observation and boll counts.

The data reported in this bulletin show that $100.00 worth of factory-mixed 6-8-4 has produced an average profit of $129.18, and $100.00 worth of home-mixed 6-8-4 has produced an average profit of $155.82 in the Flatwoods, and Shortleaf and Longleaf Pine Areas.

With home-mixed fertilizers, where nitrogen only is needed, the same increase in yield can be obtained from $52.79 worth of nitrogen as from $100.00 worth of 6-8-4 and the profit is increased from $155.82 up to $203.03; where only nitrogen and potash are needed the cost is reduced to $65.61, and the profit is increased to $190.21; where only nitrogen and phosphorus are needed the cost is reduced to $87.19 and the profit is increased to $168.63.

It is apparent that the use of fertilizers which supply only the needs of the plants determines the profit made to a very large extent. The possible savings justifies the effort necessary to find out the needs of the crop. In order for a farmer to determine whether or not he is paying for, and using phosphorus or potash or both which are not needed, it is necessary for him to conduct simple field tests on his own farm.

Conduct Tests to Determine the Needs

A fertilizer test to determine whether or not phosphorus or potash can be left out of the fertilizer can be put out with an ordinary fertilizer distributor. The fertilizer distributor should be set to put out approximately the following amounts of fertilizer per acre:

1. 200 pounds of nitrogen fertilizer.
2. 200 pounds of superphosphate.
3. 50 pounds of muriate of potash or 100 pounds of kainit, but not both.

The nitrogen fertilizer should be put out on 10 rows; the superphosphate should be put out on rows 3, 4, 5, and 6; the muriate of potash should be put out on rows 5, 6, 7, and 8. When the test is laid out:

Rows 1 and 2 have nitrogen only.

Rows 3 and 4 have nitrogen and phosphate.

Rows 5 and 6 have nitrogen, phosphate and potash.

Rows 7 and 8 have nitrogen and potash.

Rows 9 and 10 have nitrogen only.

The value of the test will be increased by repeating it three times. It should be borne in mind that different soils on one farm may respond differently.

Differences in appearance and growth of the cotton or other crops will indicate to a certain extent how much good the fertilizers are doing. However, it is more accurate to weigh the cotton or count the bolls. One hundred open bolls per 10 feet of row indicate a bale of cotton per acre.

One hundred bolls should weigh one pound. To convert open bolls per 10 feet of row into pounds per acre, multiply by 13. Where there are 50 bolls per 10 feet of row, the yield will be 13 x 50 or 650 pounds of seed cotton per acre.

The Effect of Depression Years on the Ratio Of Nitrogen, Phosphate, and Potash Applied

During good times farmers as a whole use good fertilizers, but after depression years in many counties the ratio may be so poor that the fertilizers used may not pay the cost. As an illustration the average ratio in Newton County was 5.5-8-2.5 in 1930, and 6-8-4.4 in 1938, but in 1932 it dropped to a 0.9-8-0.7. In the year of 1932 the fertilizer ratio of this county had less than 1% nitrogen and potash as compared to 8% phosphate.

Very little of the phosphate applied to cotton is harvested in the seed cotton, and after several years of fertilization with fertilizers containing a high amount of phosphate the crop does not require as much phosphate as it does where little phosphate has been used. When depression years come and the amount of money spent for fertilizers has to be reduced, the phosphate should be reduced first. Where cotton has been fertilized heavily, nitrogen alone should give very satisfactory results on the heavy soils, and nitrogen and potash on the soils known to be badly deficient in potash for cotton.

The Influence of Fertilizers on the Available Lime, Phosphate, and Potash in the Soil

Farmers have recognized that certain fertilizers produce better crops than others. They have also observed changes in the ease of plowing after the application of certain fertilizers, and that the fertility of the soil gradually decreases with the continued use of certain fertilizers. These observations have been borne out by experimental work.

Probably three-fourths of the upland soils of Mississippi, outside of the Black Prairie, are too acid for satisfactory growth of legumes or the use of acid-forming fertilizers without the use of lime. Many of the soils in the Delta and in the Black Prairie are too acid for satisfactory growth of legumes and the use of acid-forming fertilizers. Most of those which have sufficient lime at present for the growth of legumes and the use of acid-forming fertilizers will eventually become too acid where these practices are followed for a long period of time without the use of lime.

Maintaining a medium high lime content in the soil will reduce the applications of phosphorus and potash required for crop production in addition to direct increases in yield due to the lime.

Where fertilizers are used which cause the soil to become less fertile as time goes on, the decrease in fertility is due to the fact that the fertilizer takes the lime and potash out of the soil, and reduces the available phosphate in the soils. The fertilizers which increase the lime content of the soil also increase the available phosphate and potash.

One immediate effect of fertilizers reported by farmers is that where corn is side dressed with nitrate of soda by hand, hard clods are occasionally found the following year when the land is broken. In side dressing corn with nitrate of soda by hand, a small amount of the nitrate of soda is dropped by each hill of corn. As a result, a hard clod may be formed where the nitrate of soda was applied if the land is very dry when it is broken. If plowing is done before the soil dries out, no clods should be observed. When the soil where the nitrate of soda was applied is mixed with the rest of the soil, no harmful effects are produced. There is no permanent injury in this climate for the soda is leached out.

Sulphate of Ammonia is an acid source of nitrogen. It contains 20% nitrogen. To keep sulphate of ammonia from making the soil more acid approximately 3000 pounds of agricultural lime (88% pure) should be used with each 2000 pounds of sulphate of ammonia. In soils which are well supplied with lime, the use of 100 pounds of sulphate of ammonia will take approximately 150 pounds of agricultural lime out of the soil. On extremely acid soils, it will not remove as much lime.

Cyanamid is a basic source of nitrogen. In hill sections it usually does not produce as much increase in yield as nitrate of soda. Where cyanamid produces as much increase in yield per pound of nitrogen applied as does nitrate of soda, a ton of cyanamid will increase the lime content of the soils approximately 850 pounds of agricultural lime or about 40 pounds per 100 pounds of cyanamid. Where cyanamid is not as good a source of nitrogen as nitrate of soda, the increase will be less, but in any case its use will increase the lime content of the soil.

Urea is a medium acid source of nitrogen. It has a very high percent nitrogen, which is 42%. In order to keep urea from making the soil more acid, about 2700 pounds of agricultural lime should be added with each ton.

Nitrate of Soda is a source of nitrogen which will conserve the lime supply of the soil when used over a long period of time. The "soda" in nitrate of soda is very soluble and it leaches out of the soil instead of lime and potash. Due to this property, nitrate of soda tends to conserve the potash content of the soil, and over a long period of time it will increase the available potash in the soil more than any other source of nitrogen. Putting a money value on this property of nitrate of soda is very difficult, and it is sufficient here to point out the tendency without attempting to evaluate the results in dollars and cents. One ton of nitrate of soda will conserve the lime content of the soil equal to about 250 pounds of agricultural lime. Nitrate of soda contains 16% nitrogen.

Calnitro containing 16% nitrogen will leave the soil in the same condition as if no fertilizer had been applied. It will not make the soil more acid nor will it increase the lime content.

Calcium nitrate contains a little ammonium nitrate, and as a result it is not acid, and it does not increase the lime content of the soil. It contains 15% nitrogen.

Muriate of Potash does not increase or decrease the lime content of the soil.

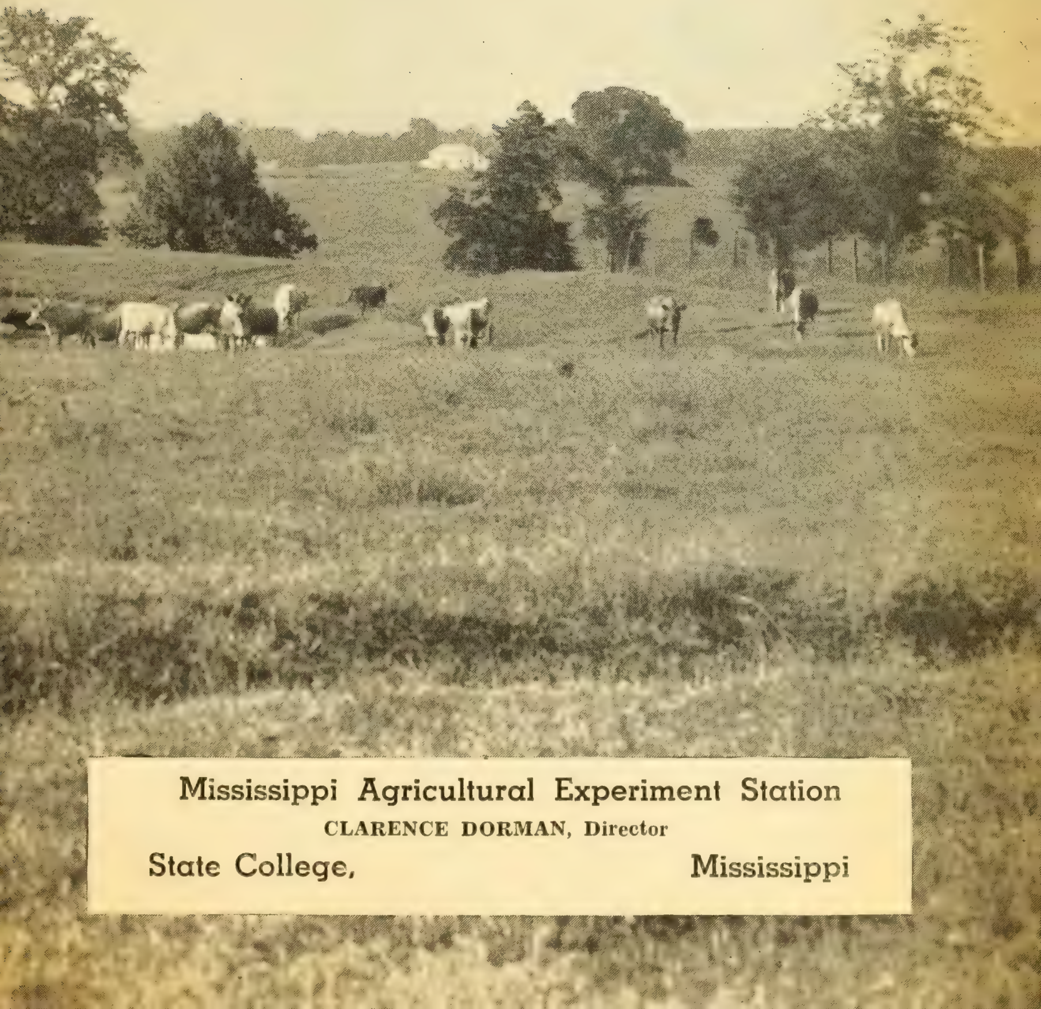
Mixed fertilizers in all probability are acid unless they are guaranteed to be non-acid forming. They should not be used on acid soils when they are acid forming.

Superphosphate contains lime equal to approximately 50% of its weight, and in many cases the good effect of superphosphate is due to its lime content. The lime in superphosphate will not sweeten sour soils, but plants can use it. On many soils the use of lime will lower the amount of superphosphate required by crops. The use of superphosphate to supply lime is very expensive.

Bulletin No. 343 May, 1940

The Place of Dairying In Mississippi Agriculture

By J. S. MOORE and W. C. COWSERT



Mississippi Agricultural Experiment Station
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A Summary of Results, Showing Effects of Combining Dairying and Feed Production with Cotton Production

In an experiment conducted by the Dairy Department of the Mississippi Experiment Station it was sought to measure and evaluate the combination of cotton and the production of dairy cows as sources of income, and to determine the influence of such a system on some of the major farm problems. It was sought to conduct the experiment under such conditions that crops would be rotated, the soil protected against erosion, due attention paid to soil fertility and productiveness, and feed needed by the dairy herd produced on three-fourths the cultivated acreage, and cotton on the remaining one-fourth.

The study conducted during the 10-year period 1930-1939 seems clearly to indicate the following results of the combination of cotton and the dairy cow:

1. The profitable utilization of more land on the farm; in this case an increase of 43%.

2. An increase in the productivity of the soil. Comparing the yields of cotton and corn during the last five years with the first five years, the yield of cotton was increased 32.7% and the yield of corn 65.49%.

3. Erosion was reduced to a minimum due largely to the fact that a winter cover crop was planted each fall on all of the cultivated land, and that there was a good sod on the pasture area.

4. A much better distribution of labor throughout the year.

5. The dairy cows furnished a ready and profitable market for the feeds grown on the farm.

6. The net returns from the combination of these products were decidedly larger than where cotton alone is depended upon for cash income. Cotton and products of the dairy cows were the two sources of money income. The other crops grown were: pasture, corn, sorghum, sagrain, and winter cover crops, which were sold directly to the cows at market prices.

7. Returns per acre less labor and seed from the various crops were as follows: cotton, per acre, $20.21; corn, per acre, $12.61; sagrain, per acre, $20.75; silage, $41.37; hay, $23.66; and pasture, $30.88.

8. The average yield per cow per year was 6,568 pounds milk, containing 328.39 pounds fat, and 5,254 pounds skim milk.

9. The feed required other than pasture for each cow was 1,523 pounds hay, 5,084 pounds silage, and 2,733 pounds concentrates. The value of the products of each cow per year less the cost of feed and labor was $47.39.

10. The income from both farm crops and herd, less labor and seed for farm, and labor and feed for herd was $3,555.34.

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The Place of Dairying In Mississippi Agriculture

J. S. MOORE, Head of Dairy Department
and
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For many years the need for a more diversified system of farming in Mississippi has been recognized. It is common knowledge that the income of the average farm is too small to meet the needs of the farmer and his family. The one-crop system of farming has been such as to favor soil erosion, loss of fertility, and decreased yields per acre.

A study of the statistics of this State in comparison with those from other States suggests that farm crops might be balanced to advantage with the growing of more live stock and that by such addition the farmer might be able to increase the sources and the volume of income from the farm which is too often confined almost wholly to that received from the sale of cotton. Few experiments could be found to show what might reasonably be expected from the combination of cotton and live stock as sources of incomes, especially the influence of this combination on some of our most serious farm problems.

Need for Diversified Production

At the time this project was planned, it was found that only about one-third of Mississippi's land area was bringing in any regular, substantial farm income. Much of the land in cultivation had become so depleted or was originally so lacking in fertility, that it was difficult, if not impossible, to secure any profit over costs of production. Where cotton constituted the principal source of income the labor was not distributed throughout the year; there were peaks of man labor requirements in the spring and again for a short period in the fall which served to limit the acreage planted and the period of profitable work. With cotton or any other one-crop system as the only or main source of income some failures are inevitable. Such failures would be less likely if other and additional crops were produced and satisfactory markets were available.

It was with these facts before us that in 1929 a project was planned to be continued over a series of years with the object of studying the combination of cotton and the products of the dairy cows as sources of income and the influence of such a system on some of the major farm problems, namely, (1) the use of the farm land; (2) the fertility of the soil, including prevention of soil erosion; (3) the distribution of labor (4) the marketing of crops; (5) the net returns from the farm.

Pasture and Cropland Used

To make this test, a small farm of 14.25 acres was selected. Six acres of this was on a rather steep hillside and unsuited for cultivation, but several years prior to the starting of this test the land was put in shape and planted to grasses and clovers for pasture for which it was very well suited. At the time this project was started there was a good sod of grasses and clovers and it would have been called a good pasture. This was set aside to be used as a pasture for the dairy cows.

The remaining 8.25 acres was utilized for cultivation. This land had at one time been discarded as unfit for cultivation but was fairly level and, as in the case of the pasture described above, for several years prior to the beginning of this test through the use of barnyard manure, cover crops and better cultivation it had been so improved that in 1929 it could be classified as average, good farmland in the upland sections of the State. Its fertility level is indicated by the production of 24 bushels of corn and 217 pounds of lint cotton per acre during 1930 and 1931.

Approximately 25% of the cultivated land (about 2 acres per year) was to be planted in cotton. None of the area was to be used for cotton production two years in succession but as far as practical the several crops grown should be rotated so that cotton would be grown one year in four on each of the plats.

The rest of the farm (about 6.25 acres per year) was to be used in growing feed for the dairy cows and this area was expected to furnish all of the feed given.

Two cash crops were utilized: dairy products and lint cotton. Cottonseed produced was exchanged for cottonseed meal to be fed to the dairy herd.

14.25 Acre Farm: 6 Acres in Pasture, 2 Acres in Cotton, 6.25 Acres in Feed Crops for Average of 4.8 Cows

4 Cows at Beginning

For the dairy herd, four cows or one cow for each 3½ acres of pasture and cropland were originally selected. This provided only 1½ acres of pasture per cow, which would not have been sufficient except for the fact that several years had already been spent in making out of this 6 acres a good pasture. Due to this and to further improvement of both pasture and cultivated land throughout the experiment, it was possible later on to increase the number of cows from 4 to 6, so that the average pasturage per cow for the 10 years was 1.25 acres. This area furnished pasture for an average of 257 days per year.

These cows were chosen from the College dairy herd. As nearly as possible cows representing the average cow in the herd were selected. When it was necessary for any reason to replace any animal or add others the same policy was followed. The records of these cows are much above the average for the State but no better than a large per cent of the cows are capable of making if given care, treatment, and feed similar to that given the cows in this experiment.

Evaluating Costs and Income

Since one of the purposes of this herd was to furnish a market for the feeds grown on the farm, the cows were charged market prices for all of the feeds given them regardless of the cost of growing the feed. Accurate records were kept, however, on the items enumerated below to determine whether or not such feeds could be grown at a profit. The following prices were used in determining the value of labor, crops, seed and dairy products:

Man labor, per hour	10c
Horse labor, per hour	5c
Tractor labor, per hour	75c
Butter fat, per pound	30c
Skim milk, per 100 pounds	25c
Ear corn, per ton	$18.00
Hay, per ton	$10.00
Silage, per ton	3.50
Mixed oats, wheat and vetch and ground soybeans, per ton	30.00
Cotton seed, per ton	20.00
Sagrain seed, per ton	16.00
Lint cotton, per pound	10c

On account of lack of facilities no effort was made to include in this program foods for the family and feeds for live stock other than the dairy cows but all will recognize that these are essential and must be provided in any well balanced farm program.

Soil Fertility Considered

It was a primary purpose that soil fertility be maintained and increased if possible by the minimum expenditure of money for chemical fertilizers and by the most complete use possible of animal ma-

FIGURE 1—THE FOUR COWS WITH WHICH THE EXPERIMENT WAS BEGUN IN 1930

nure and winter legumes. Throughout the 10-year period, superphosphate was the only chemical fertilizer purchased and that only in sufficient quantities to bring into the desired balance the fertilizer constituents of manure. Winter legumes were planted on all cultivated areas except that devoted to alfalfa, a summer legume. Manures were conserved and applied regularly both to pasture and cultivated fields, the cotton crop receiving the entire crop manurial application every year.

Four feed crops were produced most years—sorghum for silage, corn with soybeans interplanted, and alfalfa for hay. Sagrain was planted during 3 of the 10 years for silage and grain. All these feed products were fed to the dairy cows; and with cottonseed meal received in exchange for cottonseed, constituted the entire ration.

Each fall as early as possible all of the plats except those in alfalfa were planted in a winter cover crop consisting of 1½ bushels of oats, ½ bushel of wheat and 15 pounds of hairy vetch. It will be noticed under the discussion of these crops that most of them were turned under for soil improvement before planting the spring crop.

It has long been conceded that any successful livestock enterprise is first dependent upon an abundance of home grown feeds. A sound livestock enterprise, however, should constitute a fair and reasonable market for feeds produced, and should utilize such feeds at a fair market valuation so as to enable the farmer to profit from the production of feed as well as from the herd.

Direct Application Possible

In the report which is to follow, these several farm enterprises are treated separately. Expenses of feed production, yields, market valuation, and approximate profits are shown. The dairy herd is charged with feed consumed and necessary barn labor, and is credited with sales of cream and skim milk. At the end, all these factors are consolidated so as to show results secured on the basis of a family unit with 14.25 acres devoted to crop and dairy production (but not including acreage necessary for food for the family and feed for the work stock), as well as on the basis of a larger operator having 142.5 acres, 48 cows, and employing considerable labor in barns and fields.

Pasture, Once Gullied Hillside, So Improved as to Support Mature Cow per Acre at End of Experiment

Since a good pasture is so important in any well operated dairy enterprise that it may be the difference between profit and loss, every effort was made in this experiment for pasture improvement.

It has been shown that a once eroded and almost worthless area had been developed into a good pasture before this experiment was started by the stopping of gullies, the distribution of approximately 75 tons, or 12.5 tons per acre, of barnyard manure, and the planting of grasses and clovers. In addition, during the 10 years of the experiment approximately 153 tons of barnyard manure were applied to the 6-acre area, an average application of nearly 2.6 tons per acre per year. Other improvements included seeding with white clover, regular mowing and fence maintenance, and a small amount of terracing. Labor and seed per cow per year cost $3.03. Details of pasture maintenance are shown in table 2.

TABLE 2—LABOR ON PASTURE—HOURS—10 YEARS—6 ACRES

	Man		Horse		Tractor		Total Labor
Kind of Work	Amount	Value	Amount	Value	Amount	Value	Cost
Hauling and spreading manure	460.0	$46.00	920	$46.00	.....	......	$92.00
Seeding—106 lbs. white clover	8.0	.80	....	....	.....	......	.80
Mowing	58.2	5.82	114.8	5.74	1.8	1.35	12.91
Terracing	10.8	1.08	10.0	.50	0.8	.60	2.18
Fencing and repairs	59.5	5.95	....	....	.....	......	5.95
Totals	596.5	59.65	1044.8	52.24	2.6	1.95	113.84
Cost of labor per acre per year							1.90
Cost of seed per acre per year							.53
Cost of labor and seed per cow per year							3.03
Acres per cow per year							1.25

Other experiments by the Dairy Department of the Experiment Station have shown that a good pasture provides sufficient feed for the maintenance of the cow and the daily production of at least 15 pounds of milk, testing 4 per cent butter fat. To supply these requirements without pasture, our records indicate that nutrients from the following feeds would be needed in the ration: 8.5 pounds of good hay, valued at $10 per ton; 25 pounds sorghum silage, valued at $3.50 per ton; and 4 pounds of concentrates, valued at $30 per ton

The cows in this test were on pasture an average of 257 days per year. They gave milk an average of 90 per cent of the time. On the basis that a cow will secure from a good pasture 15 pounds of 4 per cent milk per day, the pasture provided feed for the production of

(257 x .9 x 15 x .04 x 48) 6661.44 pounds of butter fat which at 30c per pound would be $1,998.43 or $33.31 per acre per year. This less the cost of labor and seed is $30.88 per acre per year if the value of pasturage is measured in terms of feedstuffs that would otherwise have to be bought.

That the pasture used in this experiment would supply an abundance of grazing is indicated by the number of cows used. In the beginning 4 cows were used; later it was found possible to increase the number of cows to 6 so that the average pasturage per cow during the 10-year period was 1¼ acres.

The results obtained from the 6 acres of pasture used in this experiment coincide closely with still another experiment conducted by the Dairy Department, in which it was sought to measure the nutrients supplied by a 20-acre pasture used for grazing milk cows. Had feeds been purchased to supply nutrients furnished by this 20-acre pasture, it would have required annually 43,990 pounds hay, 129,383 pounds silage, and 20,701 pounds nutrients, these having an annual value of $756.88. Details in table 3 reveal that if these cows had been dependent on feeds at market prices without pasture, the average cost per year to equal that furnished by a good pasture would have been $37.84 per acre.

Since the 20-acre pasture was grazed by cows in sufficient numbers to utilize herb-

Figure 3—A View of the Permanent Pasture on the 14.25 Acre Combination Dairy and Cotton Farm

TABLE 3—FEEDS REQUIRED TO REPLACE A GOOD 20-ACRE PASTURE

	Hay		Silage		Concentrates		
Year	Lbs.	Value	Lbs.	Value	Lbs.	Value	Total Value
1937	48424	$242.12	142425	$249.24	22788	$341.92	$833.18
1938	50107	250.53	147375	257.91	23580	353.70	862.14
1939	33439	167.20	98350	172.09	15736	236.04	575.33
Total	131970	659.85	388150	679.24	62104	931.56	2270.65
Average	43990	219.95	129383	226.41	20701	310.52	756.88

age produced, it seems likely that a slightly higher value might have been attained than if grazed regularly by a given number as is customary, with the results that sometimes there may be an excess of grazing and sometimes a shortage.

Since the 6 acres of pasture used in this experiment were grazed regularly by a given number of cows, it seems reasonable to assume that the calculated value of $30.88 per acre is a sound and reasonable valuation of a good pasture used for dairy purposes.

Other experiments conducted by this Station show that unless there is a surplus of pasture for a considerable portion of the year, there are times in an average year when it will pay well to supplement the permanent pasture by providing other crops to meet this need.

Although good pastures furnish the cheapest and in many respects the most valuable feed grown on the farm for dairy cows, they are usually the most neglected of all farm crops. There are comparatively few good pastures in the State. If there is one opportunity that stands out prominently in favor of live stock farming in this section over most other sections of the country it is the possibility of providing a long grazing season. The farmer can well afford to use some of the best land on the farm for this purpose provided he will put it in good condition, sow a mixture of grasses and legumes, secure a good stand, and give the care and management that the pasture must have if it is to continue to produce year after year large and profitable yields. In starting such a pasture, time must be given to allow the plants to become well rooted; they must have sufficient growth to furnish good grazing; overgrazing is to be avoided; the annuals must have an opportunity to reseed the land; and the mower should be used to keep down weeds and keep the grasses and legumes tender and nutritious.

Legumes Used Throughout Experiment: Alfalfa for Hay, Winter Crops for Hay, Grazing, Seed, Soil Improvement

Due to the fact that alfalfa grows fairly well on the land used in this experiment, that alfalfa is recognized as one of our best hays for dairy cows, and that under proper conditions it will last two or more years without replanting, this crop was selected to supply the necessary hay for the cows used.

Table 4 shows the cost of land preparation and planting, and number of years each planting was in meadow.

It will be noted that two of these meadows lasted three years each, while after two years one of the areas was badly infested with weeds and the alfalfa was discontinued. It will also be noted that two of the plats had to be replanted. On account of weather conditions, a good stand was not secured and in reseeding the seed was sown and lightly covered with a smoothing harrow.

Table 5 gives the number of cuttings, the hours of labor, and the yield per plat and per acre for each year.

TABLE 4—PREPARATION OF LAND AND PLANTING ALFALFA

					Preparation and Planting					Years
Year	Plat	Acres	Planting Date	Seed Per Acre, lbs.	Man Hrs.	Horse Hrs.	Tractor Hrs.	Reseeding Date	Seed Per Acre, lbs	in Meadow
1929	5	1.65	9/14/29	30	50	42.5	11.50	....	....	3
1932	4	1.10	10/24/32	30	24	14.0	6.25	3/4/33	30	3
1936	2	1.50	3/18/36	25	48	14.0	12.00	4/13/36	25	2
Totals		4.25	....	85	122	70.5	29.75	....	55	8
Cost of labor					$12.20	$3.52	$22.31	....	....	$38.03
Cost of seed—140 lbs. at 10c										$14.00
Cost of labor and seed, per acre $12.24; 4.25 acres										$52.03

TABLE 5—HARVESTING—HOURS OF LABOR AND YIELD OF ALFALFA

Year	Plat	Acres	No. of Cuttings	Hours of Labor Man	Horse	Total Cost	Total Yield lbs.	Yield per Acre lbs.
1930	5	1.65	3	38.00	34.0	$5.50	5280	32 00
1931	5	1.65	5	148.20	83.0	18.97	17462	10583
1932	5	1.65	5	63.30	65.5	9.60	12880	7806
1933	4	1.10	4	22.75	23.0	3.43	5100	4636
1934	4	1.10	5	37.71	41.0	5.82	8061	7328
1935	4	1.10	5	35.50	40.5	5.58	6510	5918
1936	2	1.50	3	26.00	33.0	4.25	4320	2880
1937	2	1.50	6	101.25	111.0	15.67	17785	11857
Totals		11.25	36	472.71	431.0	68.82	77398	54208
Cost of labor				$47.27	$21.55	$68.82	....	....
Total cost of labor and seed, planting and harvesting								$120.85
Labor and seed cost per acre per year, planting and harvesting								10.74
Labor and seed cost per ton of hay, planting and harvesting								3.59
Yield of hay per acre—tons								3.45

The cost of labor and seed amounted to $120.85. The total yield of hay was 77,398 pounds on 11.25 acres. The average yield of hay per acre per year was 3.43 tons and the cost of labor and seed per ton was $3.59. If the hay had been baled the cost of baling would have been approximately $1.50 per ton. This hay was valued at $10.00 per ton and was sold to the cows in the project making a total of 38.7 tons at $10.00 or $387.00. This less the cost of labor and seed leaves $266.15. Returns per acre less labor and seed $23.66.

The yields of alfalfa during the first year after planting were low. The best crops were obtained the second year, and the yield the third year showed deterioration. On many of the lands in Mississippi we cannot expect satisfactory results after the third year. It may also be well to state that a large portion of the soils in Mississippi are not adapted to alfalfa. In such cases we would advise the growing of some other legume, such as lespedeza or soybeans, or some good grass for hay.

WINTER COVER CROPS ON OTHER ACREAGE

All of the cultivated area included in this project except that in alfalfa meadow was planted each fall with a mixture of 1½ bushels oats, ½ bushel wheat, and 15 pounds of hairy vetch to the acre. This particular combination may not be the best for all farms but it had previously proven quite satisfactory on our general dairy farm at the College.

Winter cover crops are valuable for the following reasons:

1. They prevent to a large extent soil erosion.

2. They provide late fall and early winter grazing.

3. They furnish hay and grain for live stock.

4. They add humus and nitrogen to the soil and are important in improving the physical condition of the soil.

Our practice on the general dairy farm is to graze in late fall and early winter all crops that have made sufficient growth for good grazing, being careful not to let the animals on the crops after a rain when such grazing would injure the land. In the spring one-third of the acreage is turned under; one-third is left for hay, which cut at the right stage and properly cured furnishes an excellent quality of hay; and one-third is allowed to mature seed to be harvested for planting and grain for feeding. In this way, a green crop can be turned under every three years.

It will be noted from table 8 that a much larger per cent was turned under in this experiment than is called for in the above plan, and we are not sure that such large amounts are necessary or advisable.

This is the only crop where the income appears to be less than the cost of operation. Attention, however, is called to the fact that no money value has been given for the crops turned under, that no charge has been made for grazing, and that out of a total of 70.5 acres produced only 14.45 acres were actually harvested, thus leaving the growth on 56.05 acres turned to the soil which, no doubt, is responsible for much improvement in the fertility of the soil which has taken place.

TABLE 8—SUMMARY OF LABOR IN THE PRODUCTION OF WINTER COVER CROPS

	No. of Acres	Man Labor Hrs.	Man Labor Value	Horse Labor Hrs.	Horse Labor Value	Tractor Labor Hrs.	Tractor Labor Value	Value
Preparation & planting	70.5	364.64	$36.46	521.26	$26.06	74.31	$55.73	$118.25
Harvesting & threshing	14.45	454.82	45.48	267.70	13.39	60.30	45.22	104.09
Totals		819.46	81.94	788.96	39.45	134.61	100.95	222.34
Cost of seed for planting 70.5 acres x 109 lbs. x $30.00 per ton								115.26
Cost of seed and labor								337.60
Seed harvested from 14.45 acres—6.17 tons at $30.00 per ton								185.10
Crops turned under—58 acres estimated 5.56 tons per acre—Tons								322
This is equivalent to 3.9 tons per year for each acre in cultivation.								

Feed Crops Included Sorghum for Silage, Sagrain for Silage and Grain, Corn with Soybeans Interplanted

SORGHUMS MOST PRODUCTIVE SILAGE CROP

Silage as a feed for dairy cows has many advantages, among which may be named, it is palatable, digestible, succulent, bulky, healthful, easily kept, and it is cheap. One of the chief advantages over hay is the fact that silage can be harvested under weather conditions that would make the saving of No. 1 hay impossible.

Many crops such as corn, sagrain, alfalfa, soybeans, and most of the grasses and legumes may be used for this purpose but for most farms in Mississippi sorghum is recommended. Some of the reasons for this are:

1. Compared with other crops, the yield is large.
2. When planted thick in 3½ ft. rows (1/4 to 1/3 bushels per acre) and cultivated early, no hoeing is required.
3. It may be planted any time between April 1 and June 15, thus making it possible to plant after winter cover crops have been removed.
4. It should not be cut for silage until the seed are thoroughly ripe but may stand for two or three weeks after this without material injury, while corn should be cut just after it passes the roasting ear stage and rapidly depreciates in quality after this point has been reached.
5. Due to the large yield and the low cost of production, sorghum is one of the most economical feeds that may be grown.
6. Ton for ton, sorghum silage is not worth as much as corn silage. One ton of the latter has a feeding value equal to 1.11 tons of sorghum but the yield of sorghum is often 1½ to 2 times that of corn.

During the ten years in which silage was grown in the experiment, there was a total of 5.95 acres planted in sorghum for silage. The total yield was 208,400 pounds, or 35,193 pounds (17.6 tons) per acre per year.

The total man, horse and tractor labor required for making this silage was $118.47 or $1.13 per ton. This cost was distributed as follows: Man labor $54.95 or $0.525 per ton; horse labor $23.20 or $0.222 per ton; tractor labor $40.32 or $0.385 per ton. Total per ton $1.13. If we divide the labor on basis of operations in growing and harvesting the crop, we have for preparation and planting $29.97 or $0.286 per ton, for cultivation $9.75 or $0.093 per ton, and for harvesting and putting in silo $78.75

or $0.752 per ton. Total per ton $1.13. It required 90 pounds of seed to plant this area. Value of seed, $1.80 or a total cost of labor and seed of $120.27.

The silage was charged to the cows at $3.50 per ton or a total of $366.45. The value of the silage over cost of labor and seed was $246.18 or $41.37 per acre per year.

Figure 4—Some of the Field Crops Grown on the 14.25 Acre Combination Dairy ad Cotton Farm

Sagrain for Silage, Grain

For three years on different plats sagrain was grown for silage and grain. A total of 8.25 acres was planted. The total yield was 47.75 tons of silage and 7.3 tons of grain, or 5.8 tons of silage and 1770 pounds of grain per acre.

Allowing one-half of the cost to be charged for silage and one-half for grain, we have the following: Total cost of labor for silage $42.40 or $0.89 per ton and cost of grain $42.40 or $5.80 per ton. The cost of labor for preparation and planting was $35.81 or $0.375 per ton silage and $2.45 per ton for grain. Total labor for cultivation was $9.12 or $0.096 per ton silage and $0.624 per ton grain. Total labor for harvesting was $39.87 or $0.417 per ton silage and $2.72 per ton grain.

On the basis of kind of labor, man labor cost was $41.41 or $0.434 per ton silage and $2.84 per ton grain. Horse labor cost $20.77 or $0.218 per ton silage and $1.42 per ton grain. Tractor labor cost $22.62 or $0.237 per ton silage and $1.55 per ton of grain. Cost of seed for 8.25 acres—4 bushels at $1.00—$4.00. Total cost of labor and seed was ($84.80 plus $4.00) $88.80.

Dividing cost equally between silage and grain, the silage cost is $0.93 per ton and the grain cost $6.08 per ton.

These feeds were charged to the cows at $3.50 per ton for silage and $16.00 per ton for grain. Returns (silage $143.25 grain $116.80) $260.05. This less the cost of labor and seed ($88.80) gives $171.25. Re-

TABLE 6—LABOR REQUIRED FOR CORN PRODUCTION AND YIELDS PER ACRE—1930-1939, INCLUSIVE

Year	Plats	Acres Planted	Date Planted	Preparation and Planting Hours of Labor Man	Hore	Tractor	Cultivation Hours of Labor Man	Horse	Times Culti-vated	Harvesting Hours of Labor Man	Horse	Yield Corn Lbs.	Soybeans Lbs.	Soybean Hay, Lbs.
1930	4A&B	3.10	5/26 6/3	15.23	22.82	2.10	17.21	16.50	3.5	7.58	3.23	1122	232	....
1931	2	1.50	4/8	24.67	27.33	4.00	8.00	5.67	2.0	10.00	6.67	2410	......	....
1932	1, 2, 4A	3.70	4/8 6/13	10.80	1827	1.66	14.62	10.70	3.3	8.78	6.49	2166	......	....
1933	3	0.90	3/29	6.67	4.69	3.06	25.28	8.33	3.0	11.11	4.44	2022	656	....
1934	3, 4B	2.90	4/3 6/15	14.65	14.48	3.45	21.90	12.41	4.0	12.76	7.24	1653	248	....
1935	2, 5A & B	3.15	3/26 3/29	25.95	15.24	1.78	33.49	10.95	5.0	30.05	31.14	4364	......	....
1936	1, 4B	3.10	3/10 4/14	15.01	25.33	2.03	33.22	15.16	6.0	17.74	9.68	2029	......	....
1937	3, 4A, 5A	2.80	4/26	18.63	21.49	3.68	13.26	7.18	5.0	19.28	6.43	3251	......	....
1938	2, 4A & B 5A & B	6.25	4/25 6/8	14.36	19.44	4.00	17.70	11.60	3.0	13.60	17.58	2788	......	....
1939	1, 2, 3, 4A & B, 5B	7.45	4/18	21.80	39.25	2.33	27.15	5.36	2.0	17.28	9.91	3084	......	9310
Total		34.85	......	167.77	208.34	28.09	211.83	103.86	36.8	150.18	102.81	24889	1136	9310
Average per acre				16.78	20.83	2.81	21.18	10.39	3.68	15.02	10.28	2489	114	931
Cost of labor per acre				$1.678	1.041	2.107	2.118	.519.	......	1.502	.514			

Total cost of labor per acre—Man labor $5.297, Horse labor $2.075, Tractor labor $2.107	$9.479
Total cost of labor—Preparation and seeding $4.826, Cultivation $2.637, Harvesting $2.015	9.479
Total cost of labor per bushel of corn, 34.57 bu. $0.274; or per ton ear corn	7.62
Value of ear corn per acre (per bushel—34.57 at 60c) $20.74—(or per ton ear corn 2489 at $18.00)	$22.40
Returns per acre less labor ($9.48) and seed ($0.25)	12.67

The corn was charged to the cows at $18.00 per ton.

TABLE 7—CORN—HOURS OF LABOR AND YIELDS—COMPARISON OF FIRST AND SECOND FIVE YEAR PERIODS

Period	Acres	Preparation and Planting Hours of Labor Man	Horse	Tractor	Cultivation Hours of Labor Man	Horse	Times Culti-vated	Harvesting Hours of Labor Man	Horse	Yield Corn Lbs.	Bu. Per Acre
1930-34	12.10	72.02	87.59	14.27	87.01	53.61	15.8	50.23	28.07	9374	....
1935-39	22.75	95.75	120.75	13.82	124.82	50.25	21.0	99.95	74.74	15516	....
Hours per acre 1st 5-year period		14.40	17.52	2.85	17.40	10.72	3.2	10.05	5.61	1875	26.1
Hours per acre 2nd 5-year period		19.15	24.15	2.76	24.96	10.05	4.2	19.99	14.95	3103	43.7
Average cost per acre per year for labor											
First period		$1.44	.88	2.14	1.74	.54	. ....	1.00	.28	1875	....
Second period		1.91	1.21	2.07	2.50	.51	....	2.00	.75	3103	....

turns per acre less labor and seed was $20.75.

One of the main purposes in growing this crop was to see whether or not a grain crop could be grown to take the place of corn where often the yields are low and the cost high. When sagrain is used for both grain and silage, the yield appears to be satisfactory and it has the advantage over corn in that it withstands drouth much better than corn and can be planted in late spring with greater assurance of success than can corn. It was found, however, that without special machinery considerable expense was incurred in removing, drying and grinding the seed which were not as palatable or as high in feeding value as corn. The stalks and leaves remaining were also less palatable than sorghum silage. If the entire plant including the seed was put into the silo, many of the seed, being very hard, would pass through the alimentary tract undigested, and the yield of sagrain was considerably less than the yield of sorghum for silage.

Corn Yield Increased Nearly 66 Per Cent During Second 5-Year Period of Test

Corn is recognized as one of the most valuable cereals, but the average yield in the State is not sufficient to justify growing it for commercial purposes. Much of the land however can be farmed in such a way that fair profits may be made if corn is grown and fed to the dairy cows and other classes of live stock especially where fertility is supplied by animal manures and winter legumes.

Corn and cotton were selected as yard sticks to measure the increase or decrease in the yearly profits or the change in fertility due to the system used.

No fertilizer was used on the land planted in corn except the turning under of a winter cover crop. Corn often immediately followed the cotton, and it is shown under the description of this crop that the barnyard manure from the herd together with phosphoric acid was distributed in the spring on land to be planted in cotton. Residual effects of this fertilizer no doubt increased to some extent the crop grown the following year. As soon as the corn was ripe and gathered the stalks were cut, the land disked, and a winter cover crop planted. Table 6 gives the detailed cost of labor and the returns for each year and the average for all.

Soybeans were planted in the corn every year, and there was gathered at a cost of $12.65 a total of 4.65 tons soybean hay and 2,030 pounds of soybean seed at a labor cost of $2.32. With the exception of the above, which constituted only a small per cent of the total amount planted, all of the soybeans were turned under with the corn stalks for soil improvement.

In order to bring out more clearly the influence of the system followed on the fertility of the soil, table 7 gives a comparison between the first five-year and the second five-year periods.

During the first five years in period 1, the yield was 1875 pounds of ear corn or 26.1 bushels per acre and in period 2 the average yield was 3103 pounds or 43.1 bushels. This is an increase during the second period over the first of 65.49%.

TABLE 1—CROPS GROWN ON EACH PLAT FOR TEN YEARS—1930-39

Plat	1	2	3	4A	4B	5A	5B
Acres	1.1	1.5	0.9	1.1	2.0	.80	.85
Year							
1930	Cotton	Cotton	Sorghum	Corn & Soybeans	Corn & Soybeans	Alfalfa	Alfalfa
1931	Sorghum	Corn & Soybeans	Cotton	Cotton	Sagrain	Alfalfa	Alfalfa
1932	Corn & Soybeans	Corn & Soybeans	Alfalfa	Corn & Soybeans	Cotton	Alfalfa	Alfalfa
1933	Sagrain	Sagrain	Corn & Soybeans	Alfalfa	Sagrain	Cotton	Cotton
1934	Cotton	Cotton	Corn & Soybeans	Alfalfa	Corn & Soybeans	Sagrain	Sagrain
1935	Sorghum	Corn & Soybeans	Cotton	Alfalfa	Cotton	Corn & Soybeans	Cotton
1936	Corn & Soybeans	Alfalfa	Sorghum	Cotton	Corn & Soybeans	Cotton	Sorghum
1937	Sorghum	Alfalfa	Corn & Soybeans	Corn & Soybeans	Cotton	Corn & Soybeans	Corn & Soybeans
1938	Cotton	Corn & Soybeans	Cotton	Corn & Soybeans	Corn & Soybeans	Corn & Soybeans	Corn & Soybeans
1939	Corn & Soybeans	Corn & Soybeans	Corn & Soybeans	Corn & Soybeans	Corn & Soybeans	Cotton	

TABLE 10—FEED AND PRODUCTION OF COWS FOR EACH YEAR. TOTALS AND AVERAGES—1930-1939, INCLUSIVE

Year	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	Totals	Average Per Cow Per Year
Feeds												
Hay, alfalfa, lbs.	7422	4182	4880	8470	3990	6327	11300	6185	10542	9828	73126	1523
Silage, sorghum, lbs.	22340	16345	18420	21490	25230	31645	28890	21425	26460	31808	244053	5084
Concentrates, lbs.	14167	11321	8876	6713	12592	17534	14658	14145	15053	16135	131194	2733
Pasture, days	242	270	365	275	282	264	213	250	244	170	2575	257
Production												
No. of cows	4	4	4	4	4	6	5	5	6	6	48	....
Milk, lbs.	29788	29328	23100	18772	29466	40391	31233	33761	40643	38790	315272	6568
Fat per cent	4.64	4.55	4.68	4.85	4.75	5.19	5.78	5.48	4.96	4.87	5.00	5.00
Fat, lbs.	1382.02	1333.11	1081.10	910.15	1398.99	2094.62	1805.30	1849.07	2017.40	1890.94	15762.70	328.39
Weeks in milk	44.2	46.0	48.8	46.5	50.5	43.3	47.0	47.8	44.2	49.0	467.3	46.7
Feed Other Than Pasture Required												
For 100 Pounds of Milk												
Hay, lbs.	24.92	14.26	21.12	45.12	13.54	15.66	36.18	18.82	25.94	25.34	240.4	35.19
Silage, lbs.	75.00	55.73	79.74	114.48	85.62	78.34	92.49	63.46	65.10	82.01	791.97	77.41
Concentrates, lbs.	47.56	38.60	38.42	35.75	42.73	43.41	46.90	40.19	37.04	41.60	412.20	41.61
For One Pound of Fat												
Hay, lbs.	5.37	3.14	4.51	9.31	2.81	3.02	6.26	3.34	5.22	5.20	48.18	4.64
Silage, lbs.	16.16	12.26	17.04	23.61	18.03	15.18	16.00	11.59	13.16	16.82	159.85	15.49
Concentrates, lbs.	10.25	8.49	8.21	7.37	9.71	8.37	8.12	7.65	8.00	8.53	84.70	8.32

Cotton, Grown on One-Fourth Cultivated Area, Increased in Yield 32.7% by Soil Fertility Program

Since cotton has long been the main money crop in the South, since our lands are well suited and our people are accustomed to the growing of this crop, and since in the past at least few crops have offered more certain returns than cotton, it is generally accepted that any farm program recommended for general adoption in Mississippi should include cotton.

In outlining the work in 1929, it was arranged to plant each year about 25 per cent of the cultivated land in cotton with the provision that this crop should not be grown any two consecutive years on the same area. As cotton was to be one of the two important sources of income, efforts were made to see that as favorable conditions as possible should be provided. With this end in view, the barnyard manure from the cows in the project to the extent of 10 tons per acre per year was applied to the land before planting the cotton. As this manure is rather low in phosphoric acid there was added to it superphosphates containing 74.8 pounds of phosphoric acid per acre. This plan allowed the putting of barnyard manure at the rate of ten tons per acre on most of the cultivated land once every four years.

Table 9 gives the itemized cost of labor together with the yield of cotton for each year during the 10-year period.

This table shows that the average yearly yield per acre for the ten years was 376.7 pounds of lint and 749.3 pounds of seed. The highest yield per acre was in 1937, the yield being 578 pounds of lint and 1100 pounds of seed. The lowest yield was in 1931, the second year after the work started, when only 199 pounds of lint was produced.

It has previously been shown that a total of 153 tons of manure was applied to the 6-acre pasture during the 10-year period, an average of nearly 2.6 tons per acre per year.

The remainder of the manure was applied to the cotton crop every year at the rate of 10 tons per acre, so that during the 10-year period a total of 213 tons of manure was applied to the total of 21.3 acres of cotton. Since the cotton was rotated, and since 8¼ acres were cultivated to all crops, the average cultivated acre received nearly 25 tons of manure

TABLE 9—LABOR REQUIRED FOR COTTON PRODUCTION AND YIELD OF LINT AND SEED

				Preparation and Planting Hrs. of Labor Required Per Acre			Cultivation: Hrs. Labor Per Acre		Picking Hrs. Labor Per Acre	Yield Per Acre	
Year	Plats	Acres Planted	Date Planted	Man	Horse	Tractor	Man	Horse	Man	Lint Lbs.	Seed Lbs.
1930	1 and 2	2.6	3/29	20.38	25.38	1.15	27.12	22.50	85.40	235	419
1931	3 and 4A	2.0	4/29	19.64	29.82	3.76	38.89	11.75	40.50	199	395
1932	4B	2.0	4/6	19.87	28.50	2.00	38.25	18.00	114.00	388	707
1933	5	1.65	4/10	24.85	16.36	13.03	79.54	21.52	126.06	484	921
1934	1 and 2	2.6	4/9	28.19	33.46	1.92	52.64	16.15	57.53	312	592
1935	3 and 4B	2.9	4/25	25.10	32.07	0.69	61.87	20.69	108.28	354	697
1936	4A and 5	2.75	4/15	26.00	24.19	2.19	61.64	14.18	103.38	484	1060
1937	4B	2.00	5/10	29.00	26.50	3.37	41.00	17.25	158.50	578	1100
1938	1 and 3	2.00	4/23	21.51	23.84	0.71	35.60	11.00	22.50	287	608
1939	5A	0.80	4/20	18.75	25.00	4.37	62.32	4.25	87.50	446	994
Totals		21.30	....	233.29	265.12	33.19	498.87	157.29	903.65	3767	7493
Average per year		2.13	....	23.33	26.51	3.32	49.89	15.73	90.36	376.7	749.3
Cost of labor per acre per year				$2.33	1.33	2.49	4.99	0.77	9.04	Total	$20.95

Cost of seed per acre 2 bu. at $2.00 $4.00. Cost of labor and seed per acre........24.95
Value of cotton (lint) per acre per year 376.7 lbs. at 10c—$37.67
Value of cotton (seed) per acre per year 749.3 lbs. at 1c—7.49........45.16
Returns per acre per year above cost of labor and seed........20.21

during the 10-year period, or nearly 2½ tons per acre per year.

It has already been shown that as a result of this fertility program, plus the turning of winter legumes, the yield of corn was increased nearly 66 per cent during the second five years.

For the purpose of determining the effects of this two-way fertility program up on cotton, the yield per acre may be summarized by 5-year periods. The average yield during the first 5 years was 323.6 pounds of lint and 606.8 pounds of seed; and during the second 5 years the average yield was 429.4 pounds of lint and 891.8 pounds of seed. This is an increase of 32.7 per cent in lint production over the yield for the first 5 years.

Average Herd of 4.8 Cows Grossed $535.93 Yearly, Or $514.83 Including Labor and Profit From Feed

The cows used in this program were selected from the College herd. Neither the best nor the poorest, but cows of average production in the herd were chosen. Naturally these had a much higher record than the average in the State, but no greater than the average that every dairyman should strive to reach. With proper care and liberal and judicious feeding—such as that given the cows used in this experiment—many cows in State dairy herds are capable of making yields as large as the animals selected for this test.

Since the experiment covered a period of ten years, it was of course necessary to replace some of the animals. This was done by selecting cows of as nearly the same productive capacity as those replaced as was possible.

Starting with only four cows, as the fertility of the soil increased yields from pastures and fields, the number of cows was raised to six; so that the average number of cows used per year for the entire period was 4.8 cows.

The feeds were all grown on the land provided for this test; and the prices charged for them are given in the general outline of the plan and are the prices used as valuations of crops as shown in tables 2, 5, 6, and 8, and in the text preceding. Including grinding where necessary, the average charge for the concentrates per ton was $21.40. The charge for hay was $10.00 per ton, and for silage, $3.50 per ton. The actual cost of pasture per cow per year was $3.09. A large part of the milk was actually sold as market milk at a higher price than is used in this study, but use of the lower prices was thought advisable, since they are approximately those paid to the farmer.

Table 10 summarizes feed and production of cows for each year of the test, together with totals and averages.

To feed the herd averaging 4.8 cows during these 10 years required 73,126 pounds alfalfa, 244,053 pounds silage, 131,194 pounds concentrates, and 2,575 cow-days on pasture. This is an average per cow per year of 1,523 pounds hay, 5,084 pounds silage, 2,733 pounds concentrates, and 257 days on pasture.

315,272 pounds of milk was produced by the herd during the period, yielding 15,762.7 pounds fat. The average cow produced 6,568 pounds of milk per year, testing 5 per cent fat, yielding a total of 328.4 pounds fat, and was 46.7 weeks in milk.

Feed required for 100 pounds milk averaged 23.19 pounds hay, 77.41 pounds silage, and 41.61 pounds concentrates.

Table 11 summarizes the feeds grown, quality and value of feeds given, barn labor, and the amount and value of products.

Hay, silage, and concentrates produced under the program of feed production had a total value of $2,313.30; production was slightly in excess of requirements, and of the total, feeds to the value of $2,196.50

were fed to and charged against the cows.

Valued at 30c per pound, butterfat produced was worth $4,728 81; this, plus $630.54 receipts for skim milk, gives total receipts from the dairy herd of $5,359.35 during the 10-year period.

Expenses include barn labor $816.00, horse labor $72.00, and feed consumed by cows, $2,196.50; total cost of feed and labor for the dairy herd during the 10-year period, $3,084.50. Receipts $5,359.35, less expenses $3,084 50, equals $2,274.85 net returns, or $227.48 annually from 4.8 cows.

The cost of feed and labor per cow for one year was $64.26, and the cost of pasture was $3.09, a total of $67.35. The average yearly returns per cow were $111.65. The returns per cow less feed, labor, and pasture were $44.30.

TABLE 11—FEEDS GROWN, AMOUNT AND VALUE OF FEEDS GIVEN, BARN LABOR AND THE AMOUNT AND VALUE OF PRODUCTS

	Feeds Grown Amount Lbs.	Feeds Grown Value	Fed to Cows Amount Lbs.	Fed to Cows Value	Feeds Not Used Lbs.	Barn Labor Man	Barn Labor Labor
						Man	Labor
Hay	87833	$439.16	73126	$365.63	14.707	816	$816.00
						Horse Labor	
Silage	304900	533.57	244053	427.09	60847	144	72.00
Concentrates	135971	1318.92	131194	1403.78*	4777	......	....
Totals		2313.30	....	2196.50	....	......	888.00

Production and Value

Milk Lbs.	Fat Per Cent	Fat Lbs.	Value of Fat @ 30c	Skim Milk Lbs.	Skim Milk Value @ 25c Per 100 lbs.	Total Receipts	Cost of Feed and Labor	Receipts Less Feed and Labor
315272	5.00	15762.70	$4728.81	252218	$630.54	$5359.35	$3084.50	$2274.85

*Includes $131.20 for grinding. Cottonseed were exchanged for cottonseed meal.

14.25 Acre Cotton and Dairy Farm Yields $515; Equal to $3,555 Net from Area Ten Times as Large

RETURNS FROM A FARM OF 142.5 ACRES

This experiment may be interpreted in terms either of a small unit, one-family combination farm and dairy, or in terms of a larger unit. The area used in the experiment was necessarily limited, and is subject to application to larger areas, as is quite commonly done in experimental work.

Since farms in Mississippi are usually much larger than the area used in this experiment, it might be well to base the conclusions on the consolidated results of the 10-year program, as though they were obtained in 1 year; in which case all average factors would be multiplied by 10. The farm would contain 142.5 acres instead of 14.25 acres; the herd would consist of 48 cows instead of an average of 4.8 cows.

Table 12 shows the total hours of man labor, horse labor, and tractor labor actually employed in the experimental farm of 14.25 acres during the 10-year period. Thus, the production of crops and the improvement of pasture, 15,926.91 man hours, 6,292.51 horse hours, and 275.76 tractor hours were employed. These total figures are employed in interpreting annual results of a farm and dairy 10 times as large as that actually used in this experiment.

Table 13 summarizes returns from farm crops and from the dairy herd during the 10-year period 1930-1939. Interpreted as 1-year results from a farm and dairy 10 times as large, these figures would indicate a farm of 142.5 acres with 60 acres in pasture. Gross production from 82.5 acres devoted to crop production would result in yields valued at $2956.11, minus

TABLE 12—LABOR REQUIRED TO OPERATE FARM AND DAIRY 10 YEARS, 1930-1939, (INTERPRETED AS 1-YEAR RESULTS FROM FARM AND DAIRY TEN TIMES AS LARGE AS USED IN EXPERIMENT)

Crops	Acres	Man Hours	Horse Hours	Tractor Hours
Hay*	11.25	594.71	501.50	29.75
Pasture	60.00	596.50	1044.80	2.60
Silage, sorghum	5.95	553.53	442.53	54.76
Silage, sagrain	8.25	208.87	212.35	16.08
Grain, sagrain	....	208.87	212.35	16.08
Corn	34.85	1856.93	1503.58	100.74
Cotton	21.30	3747.50	935.40	55.75
Dairy herd	..... .	8160.00	1440.00	....
Total	142.50	15926.91	6292.51	275.76
Days	....	1593	629	28
Laborers required	....	6	4	1

*0.9 acres for one year intended for hay were not used.

costs of labor and seed, totaling $1,675.62, to leave a net operating profit of $1,280.49.

The dairy herd of 48 cows produced butter fat and skim milk valued at $5,359.34 produced at a cost of $888.00 for labor and $2,196.50 for feed, to yield an income from the dairy herd of $2,274.85 This, added to the income from crop production, indicates an income from crop and dairy, less labor, feed, and seed, of $3,555.34.

In this project provision was made only for cash crops and for pasture and feed required by the herd. To be complete as a farming unit, it would be necessary to add the cost of foods for the family and feed for work stock and other animals kept on the farm. To meet these, farms should probably be increased in size from 142.5 acres to 200 acres or proportionately reduced.

TABLE 13—10-YEAR (1930-1939) RETURNS FROM FARM CROPS AND FROM THE DAIRY HERD LESS COST OF FEED, SEED AND LABOR; TOTAL, (INTERPRETED AS 1-YEAR RESULTS FROM A FARM AND DAIRY TEN TIMES AS LARGE AS USED IN EXPERIMENT)

CROP PRODUCTION

Crops	Acres	Gross	Labor and Seed	Net
Alflalfa, hay	12.15	$387.00	$120.85	$266.15
Sorghum, silage	5.95	366.45	120.27	246.18
Sagrain, silage	8.25	143.25	44.40	98.85
		116.80	44.40	72.40
Corn, grain	34.85	818.13	367.12	451.01
Cotton, lint and seed	21.30	939.48	531.44	408.04
Winter cover crops*	70.50	185.00	337.60	—152.60
Pasture**	60.00	....	109.54	—109.54
Totals	142.50	2,956.11	1,675.62	1,280.49

*Land used for growing other crops.
**Gross returns credited to cows.

DAIRY PRODUCTION

	Cows	Gross	Feed	Labor	Net
Dairy Herd	48	$5,359.34	$2,196.50	$888.00	$2,274.85

RECAPITULATION

No. acres in crops and pasture		142.50
No. cows in herd		48
Receipts: Cream	$4,728.81	
Skim milk	630.54	$5,359.35
Expenditures: Labor	$888.00	
Feed	2,196.50	$3,084.50
Income from dairy herd, less labor and feed		$2,274.85
Income from crop production, less labor and seed		$1,280.49
Income from crops and dairy, less labor, feed and seed		$3,555.34

RETURNS FROM A FARM OF 14.25 ACRES

There are many small farms in the State that are more nearly comparable to the size of the farm used in this experiment. The owner or manager of such farms often has sufficient family help to take care of the labor necessary for the operations on the farm and in the dairy. To supply information applicable to such farms, table 14 shows the average yearly returns from the farm and the returns derived therefrom. Table 14 supplies the actual annual average of the experiment as conducted during the 10-years, 1930-1939.

To operate the farm of 14.25 acres would require one-tenth the labor reported in table 12. Altogether there would be required 160 man days, 63 horse days, and 2.8 tractor days of labor.

Crop production valued at $295.61, less costs of $167.56 for labor and seed leaves $128.05 net from the farm operations. Milk and cream valued at $535.94 from an average of 4.8 cows minus $219.65 for feed and $88.80 for barn labor yields a dairy profit of $227.48 income from crop production, added to income from the dairy herd leaves a total income of $355.53.

It will be noted that the cost of man labor has been deducted in arriving at the net value of crops and dairy products. Since 160 days of man labor is involved in the year's operation of the combined farm and dairy, it is to be presumed that the operator would have sufficient family labor to care for the entire operation.

To add the previously deducted value of the labor of the operator, the income of crops and dairy would yield an actual income to the operator of $514.83.

TABLE 14—ANNUAL RETURNS FROM FARM CROPS AND FROM THE DAIRY HERD—LESS COST OF FEED AND SEED, AVERAGE 1930-1939

CROP PRODUCTION

Crops	Acres	Gross	Labor and Seed	Net
Alfalfa, hay	1.215	$38.700	$12.085	$26.615
Sorghum, silage	.595	36.645	12.027	24.618
Sagrain, silage	.825	14.325	4.440	9.885
		11.680	4.440	7.240
Corn, grain	3.485	81.813	36.712	45.101
Cotton, lint and seed	2.130	93.948	53.144	40.804
Winter cover crops*	7.050	18.500	33.760	—15.260
Pasture**	6.000	....	10.954	—10.954
Totals	14.250	295.611	167.562	128.049

*Land used for growing other crops.

**Gross returns credited to cows.

DAIRY PRODUCTION

	Cows	Gross	Feed	Labor	Net
Dairy Herd	4.8	$535.934	$219.650	$88.80	$227.485

RECAPITULATION

No. acres in crops and pasture		14.250
No. cows in herd		4.8
Receipts: Cream	$472.881	
Skim milk	63.054	$535.935
Expenditures: Labor	$88.800	
Feed	$219.650	$308.450
Income from dairy herd, less labor and feed		$227.485
Income from crop production, less labor and seed		$128.049
Income from crops and dairy, less labor, feed and seed		$355.534
Labor of operator		$159.30
Total income as above, plus labor of operator		$514.83

Bulletin No. 344 June 1940

THE JUDGING OF

LIVESTOCK, DAIRY, POULTRY AND CROPS

Compiled by

H. O. WEST

Coordinator Research Information

Jointly Representing

Mississippi Agricultural Experiment Station

and

Mississippi State Vocational Board

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PART I

INTRODUCTION

Livestock, Dairy, Poultry, and Crops judging contests occupy an important place in the Future Farmers of America work in Mississippi. An opportunity is afforded to give a great deal of worthwhile training and experience to the students who participate that will stay with them as long as they live.

The competition afforded serves as an incentive to get the boys to work in training for the contest. This training should begin in the individual schools where the students of that school are competing with one another for a place on the judging team. The students making the judging teams continue their training and compete in the local F. F. A. district elimination contest and the winners in this contest compete in the regional contest, held in connection with the livestock shows. The regional winners compete in the State Contest at State College, and the winner of the State Contest represents Mississippi at the National Future Farmers of America Convention at Kansas City.

In judging livestock, dairy cattle, and crops the judging team is composed of three members and one alternate, and in poultry the judging team is composed of two members and one alternate. The classes of livestock, dairy cattle and poultry, to be judged, are composed of four animals. In crop judging, a class of corn is made up of four ten-ear exhibits; sweet potatoes and Irish Potatoes is made up of four samples of one gallon to one peck to each sample, and a class of cotton is composed of four samples for grade and four samples for staple.

The need for information and help in training F. F. A. judging teams is responsible for the preparation of this bulletin. To become a good judge of livestock, dairy cattle, poultry, and crops will require a great deal of study, and actual practice. It is hoped that this bulletin will, at least in part, meet the need for information to study, and that the judging teams will be better prepared than ever before.

Every farm boy should know how to tell a good animal when he sees one and certainly he should know how to tell to some extent what the grade and staple of his cotton is before it is carried to market. What is a better way of learning these things than by training for and participating in the F. F. A. judging contests?

Information is presented in this bulletin on essentials to be considered in judging all classes of livestock, dairying, poultry, and crops.

PART II

LIVESTOCK JUDGING

Livestock judging involves beef cattle, horses and mules, hogs and sheep. In this section these classes of livestock are discussed taking into consideration the different breeds of the above mentioned classes.

JUDGING BEEF CATTLE

To judge beef cattle successfully it is important that the judge know the different parts of the animal, and what the ideal for these parts are. The characteristics of the different breeds are very important. Perfection in judging can be reached only through study and actual participation in judging.

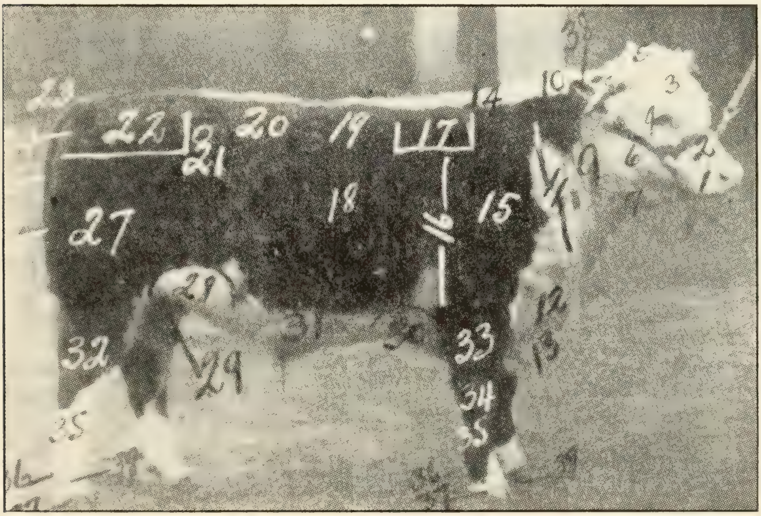


Figure 1. Points of the beef steer

1. Muzzle
2. Face
3. Forehead
4. Eye
5. Poll
6. Jaw
7. Throttle
8. Horn
9. Neck
10. Crest
11. Shoulder vein
12. Brisket
13. Dewlap
14. Withers
15. Shoulder
16. Heart girth
17. Crops
18. Ribs
19. Back
20. Loin
21. Hip bone
22. Rump
23. Tail head
24. Pin bones
25. Tail
26. Twist
27. Thigh
28. Rear flank
29. Cod or scrotum
30. Front flank
31. Belly line
32. Hock
33. Fore-arm
34. Knee
35. Shank
36. Dew claw
37. Hoof
38. Ear
39. Pastern

Placing Card for Breeding Beef Cattle

Contestant's No.__________Team No.__________Class__________

POINTS FOR COMPARISON	First	Second	Third	Fourth	Score
1. General Appearance: Size, form symmetry, breed and sex characteristics					
2. Fore Quarters: Head, neck, shoulders, chest, crops, ribs, forelegs					
3. Hind Quarters: Loin, rump, round, hind legs					
4. Quality and Condition: Size of bone, pliability of hide, smoothness and thickness of natural flesh					

(A) Average of the above scores

	First	Second	Third	Fourth	Score
(B) Final Placing Order					

FINAL SCORE: A+B÷2=

Prepared by the Bureau of Animal Industry, U. S. D. A.

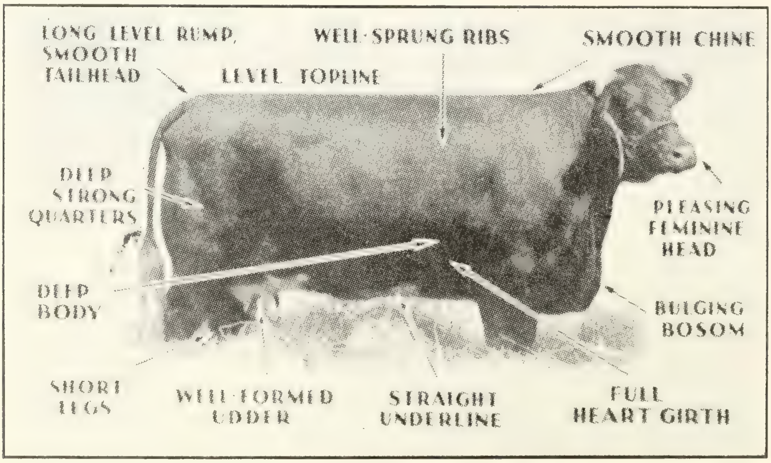

LONG LEVEL RUMP, SMOOTH TAILHEAD
WELL-SPRUNG RIBS
SMOOTH CHINE
LEVEL TOPLINE
DEEP STRONG QUARTERS
PLEASING FEMININE HEAD
DEEP BODY
BULGING BOSOM
SHORT LEGS
WELL-FORMED UDDER
STRAIGHT UNDERLINE
FULL HEART GIRTH

Figure 2, The essential qualities in a good beef cow

In judging breeding and fat beef cattle there would be some variation in the value placed on different points to be considered in judging. These factors should be considered in preparation for judging.

The score card is used in placing a class of animals as a means of comparing the different animals of a class in a systematic manner. The following points are considered in judging a class of beef cattle.

1. General Appearance

The general appearance includes weight, form, quality, and condition. In comparing the general appearance of different animals one must consider the relative merits of these points as a single unit. The general appearance is a fair index to the placing of the animal, but the other details must be taken into consideration before a final decision should be made as to the relative merits of different individuals.

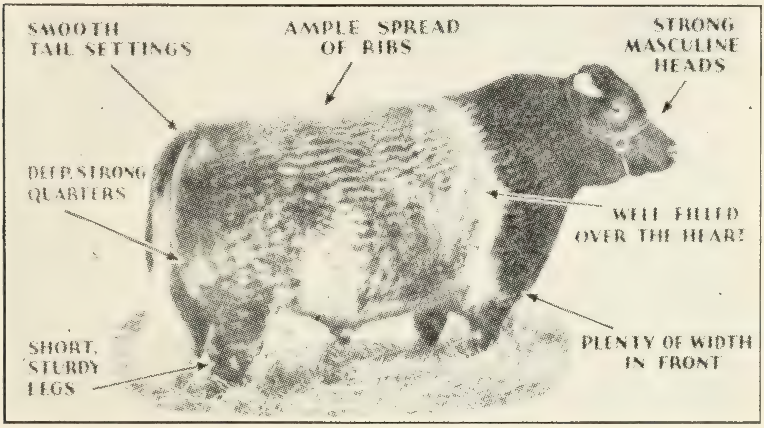

SMOOTH TAIL SETTINGS
AMPLE SPREAD OF RIBS
STRONG MASCULINE HEADS
DEEP, STRONG QUARTERS
WELL FILLED OVER THE HEART
SHORT, STURDY LEGS
PLENTY OF WIDTH IN FRONT

Figure 3, The essential qualities in a good beef bull

Weight—The weight of an animal according to its age is considered important as an indication that the greatest possible growth and fattening have been taking place every since birth. Early maturity is desired in beef cattle because it is highly important to have animals which begin to put on flesh early and at the same time show size, vigor and quality.

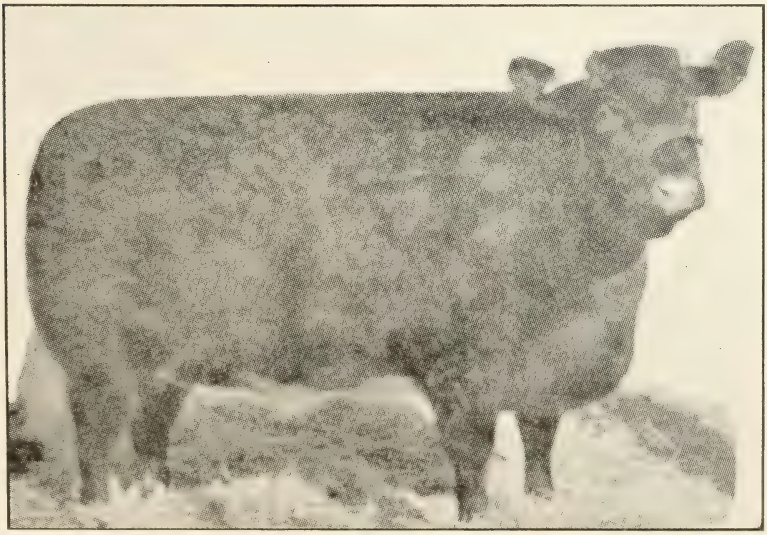


Figure 4, Desirable form for beef cattle

Form—In judging fat steers the point of view taken must be largely that of the butcher, and therefore the favored fat animal is of low-set, deep, broad, compact sort that will yield a large quantity of valuable meat. A steer that is high on the legs, cut up in the flank, and small in heart girth rarely makes a good feeder and it is usually the case that such individuals do not develop into the most desirable fat kind.

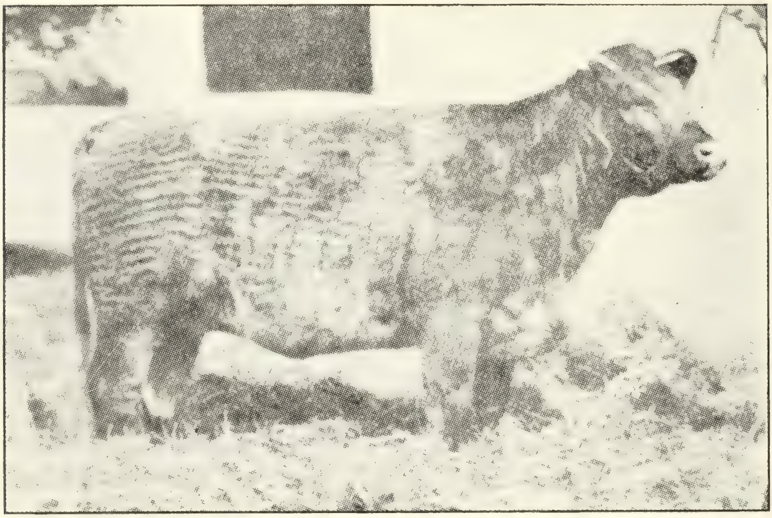


Figure 5, Undesirable form for beef cattle

Breed and Sex Characteristics—A breeding animal must, if it is a purebred, have all the particular characteristics which distinguish the breed to which it belongs from any other. For example, the Hereford must be red with a white head and white marking on the top of the neck, on the breast and underline. An Aberdeen Angus must be black and be naturally polled. A Shorthorn may be any com-

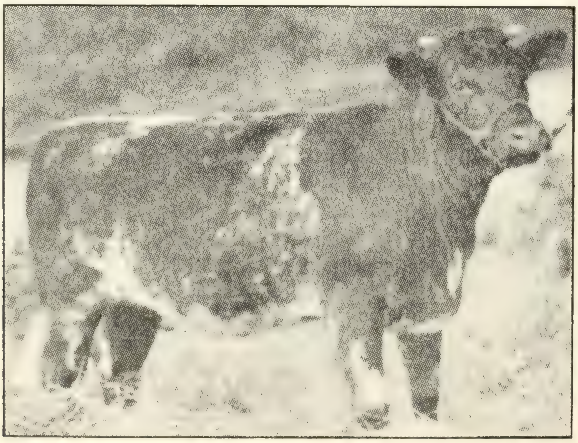


Figure 6, Undesirable form for beef cattle bination of red and white or entirely red or entirely white. It must be large and have a small head and horn. The horn of a Shorthorn is much smaller than that of a Hereford.

The bull should be masculine in the head, have the heavy crest on neck and slightly heavy forequarters. A bull that does not have a good, strong, burly, masculine head should not be selected to head a good purebred herd. The cow, on the other hand, is feminine in the head, lacks the development of forequarters which the bull has and is heavy through the middle and wider at the hips than the bull.

2. Forequarters

The forequarters include the shoulder vein, shoulders, brisket, and legs. The forequarters should be well proportioned so as to connect smoothly with the neck and body. Coarseness in the forequarters should be avoided, but a fullness of the various parts is desirable.

The shoulder vein should be full and the shoulders smooth, compact, and evenly covered with flesh so that the neck fits snugly into the body. This part should be free from coarseness and the shoulder blades should be

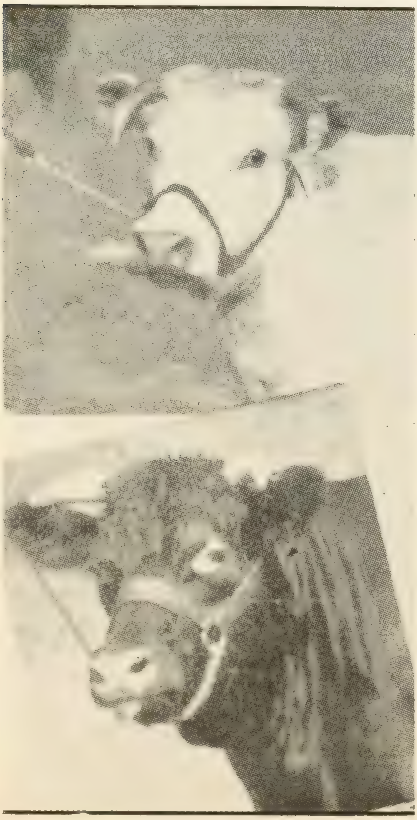


Figure 7, Desirable head and neck

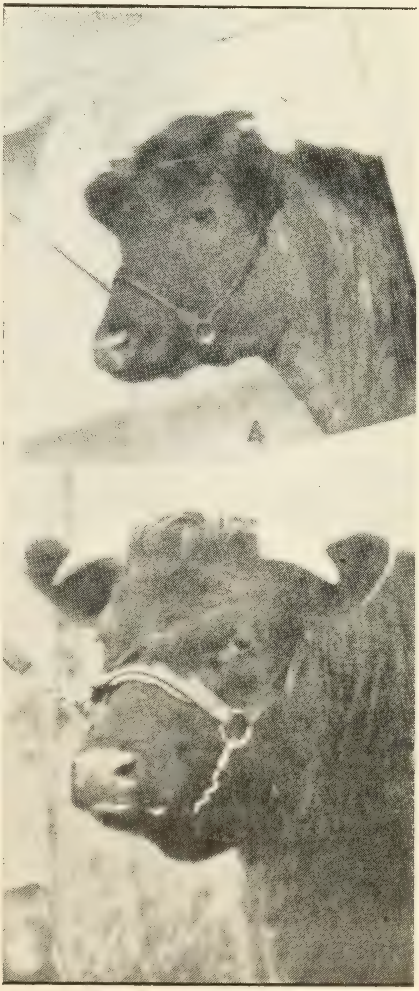


Figure 8, Undesirable head and neck

practically hidden from view. The brisket should be medium sized and prominent enough to make the body appear rectangular as viewed from the side. Freedom from coarseness is desired in the brisket. The legs should be short, straight, set well apart, and show refinement which acts as an indication of quality and a high dressing percentage in the carcass.

The head and neck are not of importance on account of the meat they contain, but because they serve as an indication of the development of the rest of the body. In the feeder or unfattened individual the appearance of the head and neck can be taken as an index of the feeding qualities of the animal. The head serves as a condensed reflection of the rest of the body. To most experienced cattle feeders a view of the head is sufficient to tell whether the animal is a good one.

The head should be broad and short because those qualifications accompany a thick, low-set, blocky body, while a long narrow face usually accompanies a narrow and upstanding body and other features which are undesirable in a beef animal. The muzzle should be broad and the mouth large, because they indicate a good appetite. The nostrils should be large and open, showing good lung capacity. The eyes should be clear and prominent and have a docile appearance, indicative of a quiet temperament. The face should be short and the jaws strong and wide apart at the base. As viewed from the side the profile of the head should show a wide angle. The ears should be medium sized, of fine texture, and covered with fine, silky hair. If horns are present they should be small or medium sized and free from undue coarseness.

The neck should be short and thick and should blend smoothly with the shoulders. The top line of the neck and the back should form a straight line. The throat should be clean and the dewlap light. A long, narrow, ewe-shaped neck is undesirable because it is often associated with poor feeding qualities.

3. Hind Quarters.

The hips, rump, thighs, twist, and legs make up the hind quarters. The hind quarters should be deep and as broad as the shoulders. The hips should be smooth and show no prominence. The rump should be long and wide and gradually round off smoothly from hips to tail head. The rump should be free from patches and rolls caused by uneven deposits of fat. The thigh should be deep and full and the twist deep and plump. The twist constitutes the portion below the tail head on the inside of the leg. The thigh is the outer part of the leg. Both of these constitute the so-called quarter. The hind legs, as in the case of the front ones, should be wide apart, short, straight, and show a fine shank and fine-quality bone.

Great emphasis should be placed upon the development of the hind quarters because the cuts in this part of the body contain some of the highest-priced and best quality meat. The hind quarters in the carcass contain about 23 per cent of the meat of the entire animal. In cutting the carcass the loin and flanks are included with the hind quarters. In making out the score card for fat cattle the purpose has been to assign values to the various parts of the animal corresponding to the relative market values of the corresponding cuts and not to the corresponding relative weights. It is usually considered that the front half of the animal weighs 52 per cent and the hind half 48 per cent. In figuring the relative market values of these parts, based on wholesale prices, the hind half of the carcass is worth about 54 per cent while the front half is worth about 46 per cent. This gives the reason why due emphasis should be placed upon the score of the hind quarters and the loin of the animal.

The body of the animal contains the most valuable cuts of beef. Included under this heading are chest, ribs, back, loin, and flank. In general, the body should be broad and deep with the underline and the top line parallel or nearly so. The body should be well rounded with well-sprung ribs but free from paunchiness.

The chest of a good individual should be wide, deep, and have a large girth. The crops must be full so that there is no depression behind the shoulder.

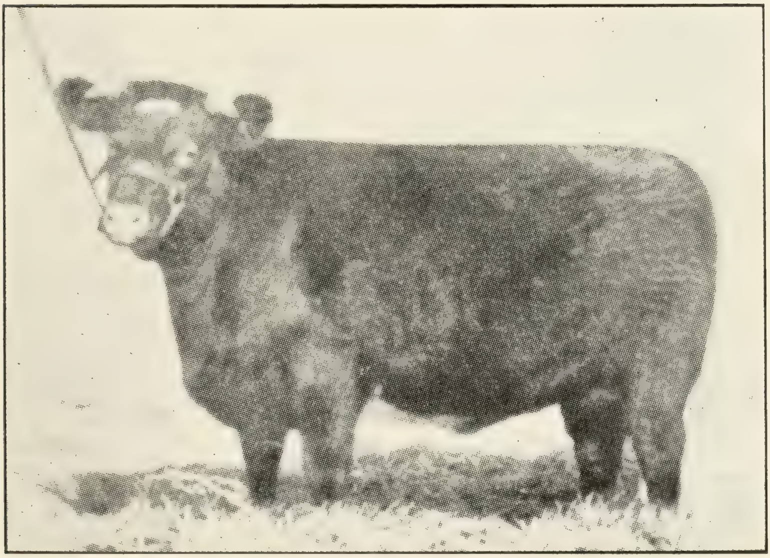


Figure 9, Exceptional rump and hind-quarter development with extreme smoothness throughout

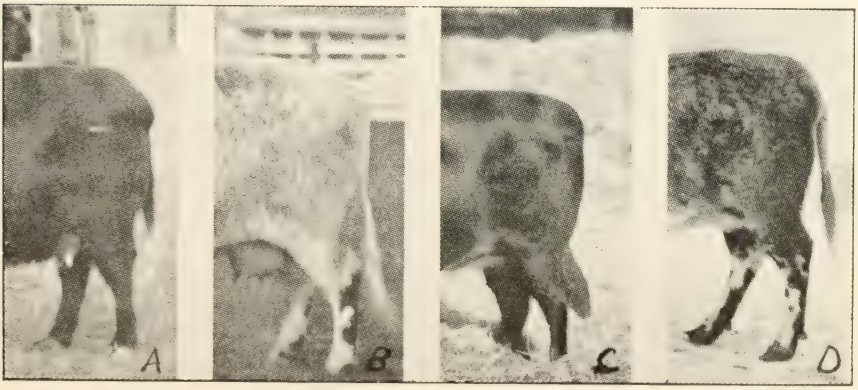


Figure 10, A, Gaudy rump. Short quarters. Light underpinning. B, sloped rump, thin thighs. Sickle hocked. C, Uneven rump. Thin thighs. Bad legs. Gine bone. D, Poor rump and buttocks. Sickle hocks. Bad feet.

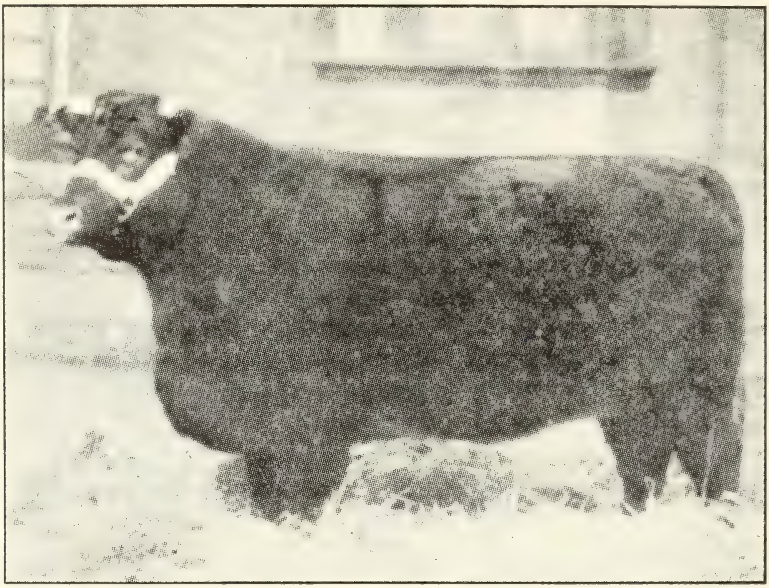


Figure 11, Desirable top line

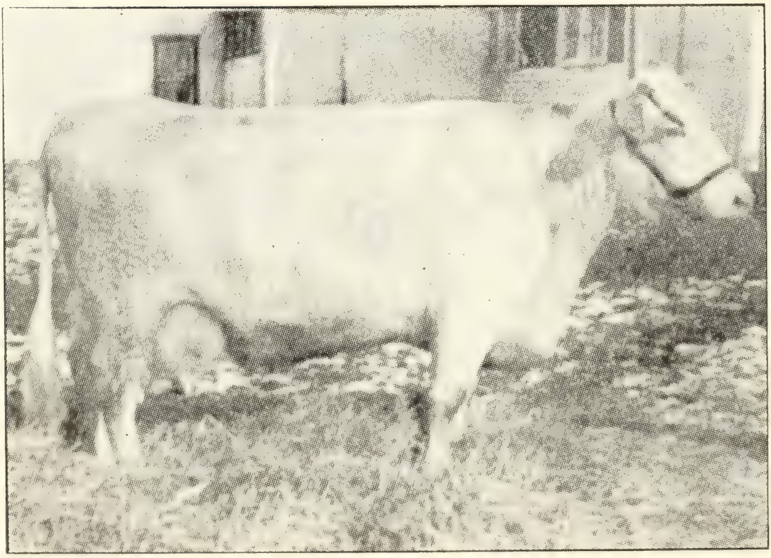


Figure 12, Undesirable top line

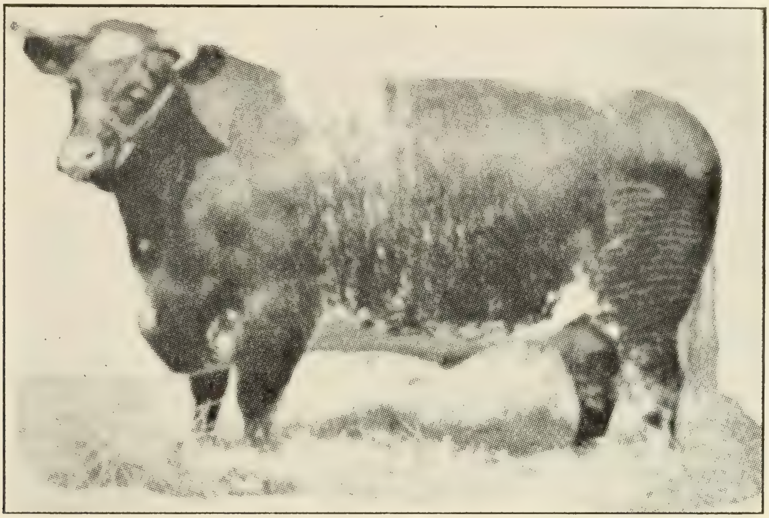
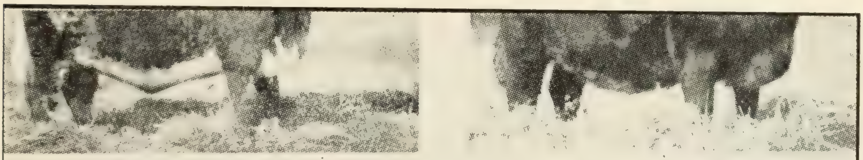
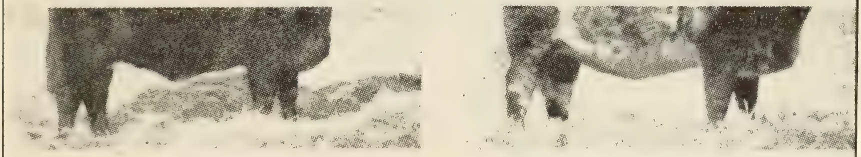


Figure 13, A near-ideal underline and an unusually smooth symmetrical body



Extremely low-hung navel. *Pot belly. Note deficient fore rib.*



Low navel. Upturning flank. *Bulging middle. Cut-up flank*

Figure 14, Undesirable underline

4. Quality and Condition

Quality in the fat steer means that the animal should have the proper kind of bone, hair and skin, which is known as "general quality"; also a smooth, springy or firm covering of flesh, which is known as "handling quality." General quality, which is largely determined by the eye, is indicated by a clean, small bone; soft, silky hair; small, dense horn; and a loose, mellow, pliable hide. A coarse head, open shoulders and heavy, coarse bone indicate poor quality. Handling quality is indicated by a thick, even covering of firm, springy flesh over the entire body, especially on the ribs and loin. The animal should be free from lumps and patches which often occur on the ribs and around the tail head. These patches are caused by the fat being laid on unevenly and are indicative of an uneven carcass.

By condition we mean the degree of fat together with the natural fleshing or muscling of the animal. The degree of condition is determined by handling the animal along the ribs and over the back and loin. As these are the most valuable parts of the animal it is desirable to have them in high finish. A full tongue root, a full cod and a thick flank also indicate high condition. But the animal that is well covered over the ribs and loins is in greater demand than the animal bare in these regions but showing a full cod and a thick flank. Do not rely upon the eye only, in determining condition, but on both observation and handling. Animals intended for butchering should be well fatted and in high condition because the meat from such animals is more tender, juicy and palatable and can be stored for a longer time than meat from animals in low condition.

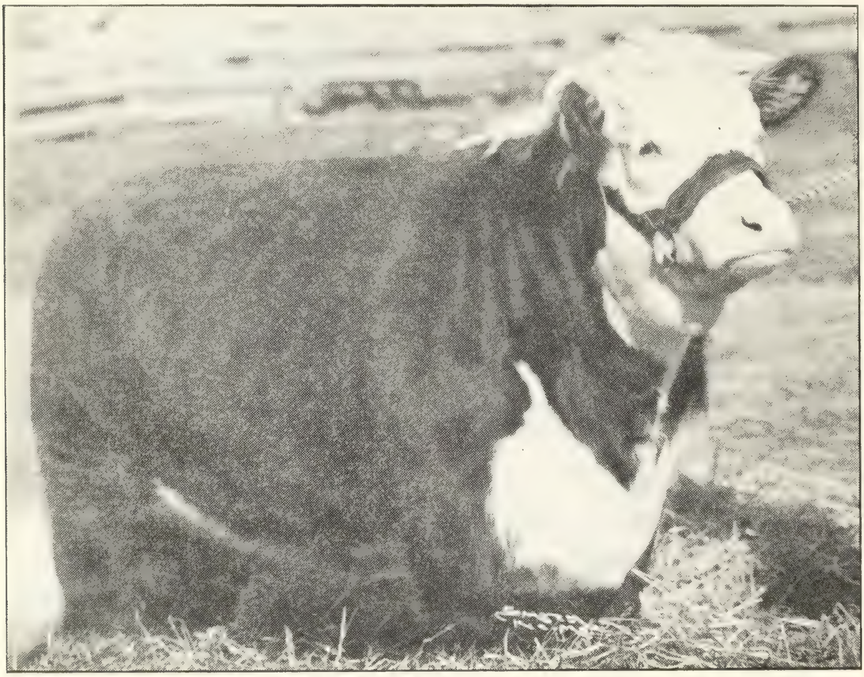


Figure 15, Desirable type cow
(Owned by M. A. Moore, Senatobia, Mississippi and bred by T. C. Potts, Crenshaw, Mississippi)

Breeds of Beef Cattle

The breeds of beef cattle discussed here are Hereford, Aberdeen-Angus, Shorthorn, Polled Shorthorn, Polled Hereford.

The Hereford

History: The native home of this breed is Herefordshire, England. Early breeders selected animal of large size which possessed good grazing ability; and, at the time of the founding of this breed, Hereford steers were known as the greatest draft animals of that country. The first Herefords were imported to this country in 1817 by Henry Clay of Fayette County, Kentucky. Some years later animals of this breed were imported to the United States in large numbers and the American breeders selected animals of a smaller type, capable of carrying more meat. As a result the present day American Hereford is far superior to the English Hereford in that they mature earlier and dress a higher percent of edible meat.

Conformation. The Hereford has been bred strictly for beef production; therefore it is deeply fleshed, closely coupled, thick bodied, and close to the ground. Breeders have not tried to produce good milking Herefords; therefore cows of this breed produce just about enough milk to raise their own calves. The Hereford is the most popular breed of cattle known for the range, because it is a good grazer and has ability to withstand the rigorous conditions of the range country. This breed is the equal of any other for the production of baby beef or heavy steers.

Color. The colors are red and white. The head and top of the neck, the breast and underline, bush of the tail and the legs below the knees and hocks are white.

Size. Hereford cattle are among the largest, mature bulls weighing 2250 pounds and cows weighing 1400 to 1600 pounds.

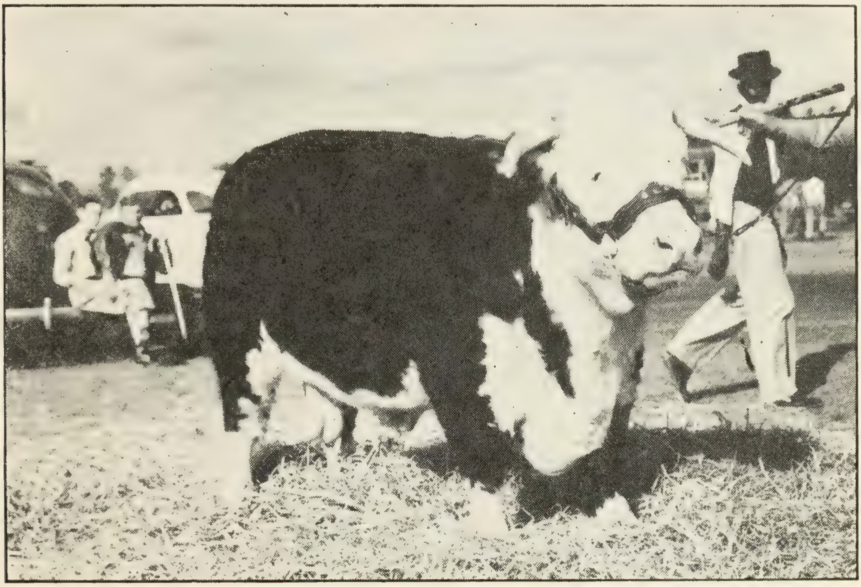


Figure 16, Hereford bull. Desirable type.
(Owned by J. F. Goodnight, Sardis, Mississippi and bred by T. C. Potts, Crenshaw, Mississippi)

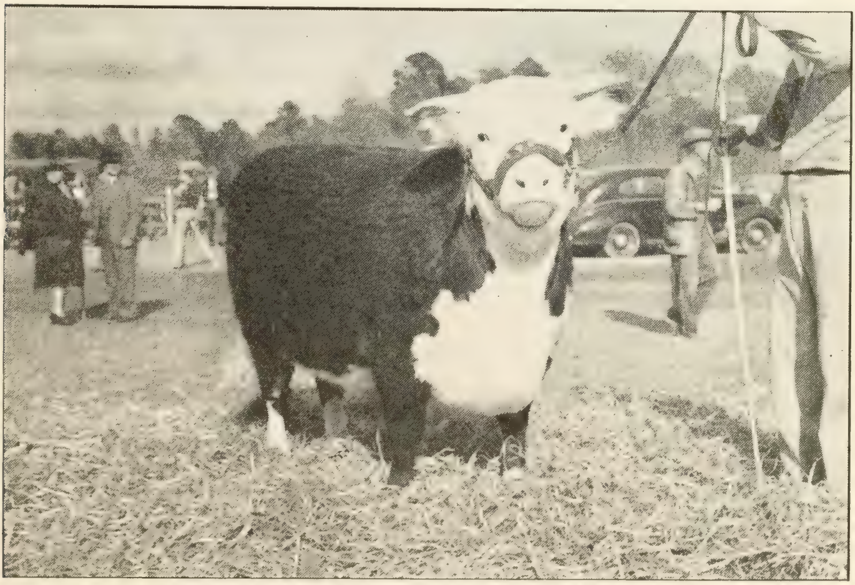


Figure 17, Hereford cow
(Owned by J. F. Goodnight, Sardis, Mississippi)

The Aberdeen-Angus

History. The native home of this breed is northeastern Scotland where the land is hilly or mountainous and well suited for grazing. In founding this breed the Scotch breeders developed a low-set, compact, thick-meated animal with fine bone that has always been known as a good feeder.

Conformation. The head is small and is naturally polled or "muley." Animals of this breed are inclined to be nervous, but if handled with care are quiet. The body is somewhat more cylindrical in shape than that of the Hereford or Shorthorn. Compactness, smoothness and symmetry are the important points of the Aberdeen-Angus. The records of this breed at the International Live Stock Exposition show that it is one of the best in producing high-class carcasses. The Aberdeen-Angus are noted for their feeding ability and early maturity and therefore are extremely popular for baby beef production.

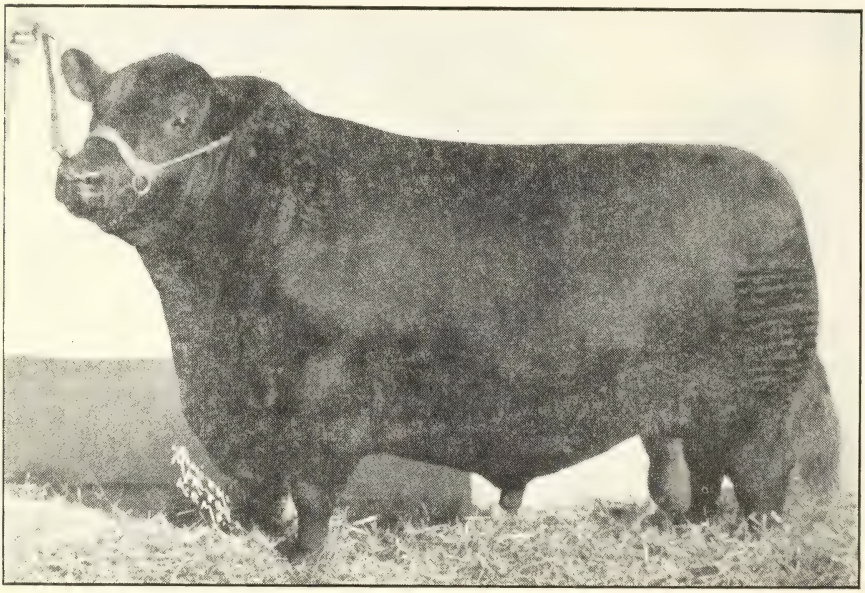


Figure 18. Aberdeen Angus bull

The Shorthorn

History. The original home of this breed is northeastern England, where it has always been the most popular breed of beef cattle. Shorthorns were first imported to Kentucky in 1817, and a quarter of a century later this State was the greatest Shorthorn center in America. Kentucky was the only State that ever produced Shorthorns good enough to send back to England for breeding stock.

Conformation. This is the largest breed of beef cattle we have and the most representative animals are broad, squarely built, possessing a wide rib and a deep body. As a rule they are hardly as low set as the Hereford or Aberdeen-Angus.

Some families of Shorthorns have been developed for milk production while others have been developed for maximum beef production. The milking Shorthorn type usually is longer in body and more angular, having a well developed udder, a large barrel or feeding capacity and longer legs than the beef type Shorthorn.

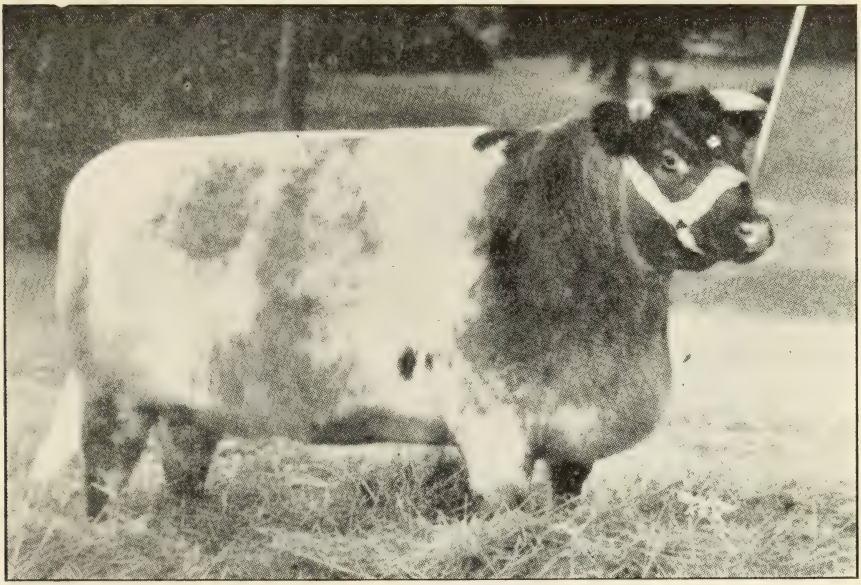


Figure 19, Shorthorn cow

The Shorthorn crosses well with other breeds of cattle and it is more widely distributed than any other breed of beef cattle. Its popularity has carried it to all continents.

Color. The colors are white or red or any combination of the two, which may be roan or red with white spots. At present the dark roan or red animals are the most popular as breeders.

Size. The largest of the beef breeds. Mature bulls weigh 2200 to 2300 pounds and mature cows 1600 pounds or more.

Polled Shorthorns

This breed is the same as Shorthorns except that the horns are not present. These animals are naturally polled, "muley," the same as Aberdeen-Angus, but the color and conformation are the same as regular Shorthorns. In former years this breed was known as Polled Durhams and were registered in that name. For some years Polled Shorthorns have been down as Double Standard Polled Shorthorns and are registered in the American Shorthorn Association as well as the American Polled Shorthorn Association. This breed has not approached the ideal beef animal so nearly as the horned Shorthorn.

Polled Herefords

The Polled Herefords is an offshoot of the Hereford breed, developed entirely in the United States. Animals of this breed have the same markings and same general characteristics as their horned relatives but the breeding and selection within the ranks of the Polled Herefords has not been so constructive and careful as it was with the horned cattle. Therefore, the animals of this breed usually fall short of the requirements of the present day Hereford.

References: Kentucky Extension Service Circular 96, "Fundamentals of Livestock Judging, a Study of Types and Breeds," Lexington, Kentucky.

"Illustrated Lessons in the Judging of Beef Cattle," American Shorthorn Breeders Association, 7 Dexter Park Ave., Chicago, Illinois.

Breed Associations.

JUDGING HORSES AND MULES

To become a good judge of horses, one must first acquire a clear knowledge of the standards of type under consideration. The first essential to sound judgment in placing a ring of draft horses, for example, is a knowledge of what constitutes excellence in a draft horse. To this must be added a knowledge of the breed requirements. Such information can be acquired only through study, observation, and practice.

In order to become familiar with the various parts of a horse, and to learn to recognize the relative value of horses, the following score card is used. The principal purpose of the score card is to draw attention to small points which would not otherwise be noticed but which, in the aggregate, have considerable bearing on the usefulness of a horse. The score card provides a means of comparison and an opportunity to place a class according to the way the particular judge sees the animals.

Comparative Measurements of Horses

Knowing the usual height and the weight of the various breeds, horsemen visualize the size and the conformation of the horse with reliable accuracy. To be able to do this, calls for skill and this may be obtained only by experience. As an aid in judging, a few of the more significant dimensions were taken of both draft and driving horses. These measurements are summarized in the following tabulation.

Comparative Measurements of Draft and Driving Horses

Parts Measured	TYPE	
	Draft	Driving
Number of horses measured	55	32
Weight	1613 Pounds	—
Height at withers	66.0 inches	61.7 inches
Height at croup	66.0 inches	61.6 inches
From point of shoulder to point of buttock	67.8 inches	62.8 inches
From lowest point of chest to ground	33.5 inches	34.0 inches
Circumference of body at girth	90.0 inches	70.0 inches
Length of head	26.6 inches	24.6 inches
Length of shoulder	27.2 inches	23.9 inches
From withers to hip	30.4 inches	28.5 inches
From point of hock to ground	25.5 inches	24.0 inches
From point of hock to hip		40.0 inches

Placing Card for Mules and Draft Horses

Class No.____________

Class Name____________________________________

Contestant's Number____________

PLACEMENT DIVISION	Placings				Grade
	First	Second	Third	Fourth	
General Appearance					
Body					
Feet and Legs					
Action					
FINAL PLACING					
Final Grade					

Desirable Characteristics Which Should Be Possessed by All Horses and Mules

The desirable characteristics which should exist in all horses and mules are:

1. A strong heavily muscled back, which seems short.
2. A short, wide, strong, heavily muscled loin.
3. A deep chest, wide through from side to side.
4. A roomy middle, due to long, well sprung ribs, and a capacious abdominal region.
5. Well set legs, pasterns and feet; that is, they should be correct in position, viewed from front, side, or rear.
6. Strong leg joints, deep from front to rear, that are clearly defined, with dense bone of good quality.
7. Straight action and good wind.
8. Good head, eyes, and temper.

These characteristics are basic and should be virtually the same in all good horses or mules, regardless of size or type.

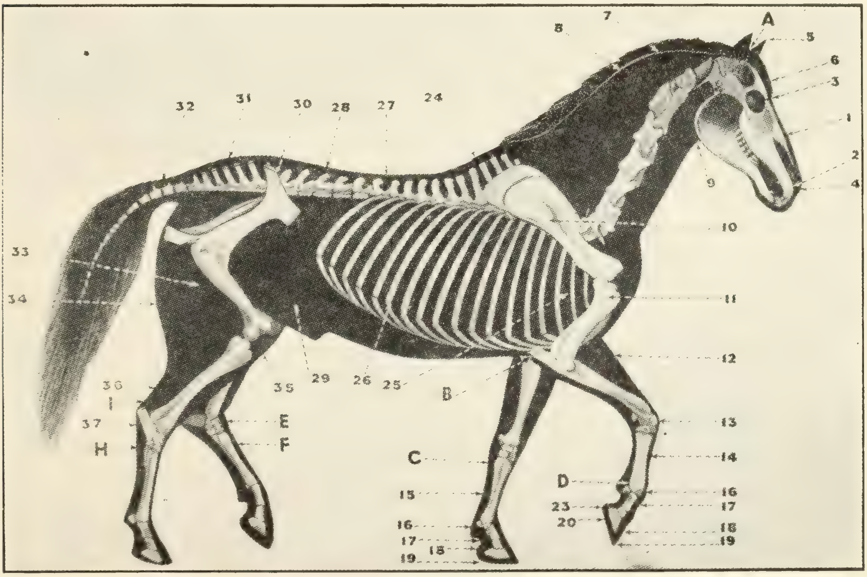


Figure 20. The skeleton of the horse, showing the location of the bones, the degree to which the skeleton and the muscle influence the form, and also the location of the various parts and location of unsoundness, when present

1. Face
2. Nostrils
3. Eye
4. Nose
5. Ear
6. Forehead
7. Neck
8. Crest
9. Throatlatch
10. Shoulder
11. Arm
12. Forearm
13. Knee
14. Cannon
15. Tendons
16. Fetlocks
17. Pastern
18. Foot
19. Horn of foot
20. Frog of foot
21. Sole of foot
22. Bars of foot
23. Heel of foot
24. Withers
25. Chest
26. Ribs
27. Back
28. Loin
29. Flank
30. Hip
31. Croup
32. Tail
33. Thigh
34. Quarter
35. Stifle
36. Gaskin or lower thigh
37. Hock

A. Poll Evil
B. Capped Elbow
C. Splint
D. Windgall
E. Bone Spavin
F. Bog and Blood Spavins, usually slightly above this
H. Curb
I. Thoroughpin

1. General Appearance

Height—The height of the horse is measured in hands and inches, the hand being equal to 4 inches. For example, the height of a horse may be given 16-2, meaning 16 hands and 2 inches, or it may be given as 16½ hands. To come into the draft class, a horse should measure at least 16 hands, while probably the most desirable heights are from 16½ to 17½ hands.

The height of a horse is measured from the top of the withers to the ground. If an accurate measurement is desired, it will be necessary to use a measuring stick. When this is not available, a fairly accurate measurement may be made by using the height of the chin or the level of the eye as a guage. The person should stand beside the horse on a level with his front feet, and note where the level of his chin or his eye comes in respect to the horse's withers.

Weight—In order to be classed as a draft animal, a horse must weigh at least 1500 pounds. This weight should be due to a massive form, made up of heavy muscles and large bones, and not to excessive fat.

Weight is essential in holding the horse's feet to the ground, in order to give him a chance to exert his physical force. The greater the weight that falls against the collar, the greater will be the pull that the horse is able to exert. Weight also helps to establish the value of the draft horse on the market. For many years the horses with the greatest weight, they being equal in other respects, have brought the highest prices.

Form—The form of the draft horse should be low, massive, and symmetrical, indicative of great strength. The body should be of such depth and width as to give good capacity, and the bones should be well covered with large, heavy muscles. The compact body should be set squarely on sturdy legs. Too short legs are as objectionable as too long ones, however, as they affect the efficiency of the horse. Lack of depth and width, ranginess, and lack of muscling throughout are things to be severely criticized in the draft horse.

Quality—Quality is that indication in a horse which shows fineness of finish and wearing ability. Quality is shown by refinement of general appearance, for instance, in a clean-cut, well-defined head with thin lips and small ears, also by neatness and refinement of neck and withers and by soft, silky hair and pliable skin. Quality is also shown by clean, hard cannons with clean, well-defined tendons, giving the cannon a flat appearance, by hard, clean, well-defined joints, and by hard, smooth, fine-textured hoofs.

The term quality as applied to the horse means the opposite of coarseness, grossness, or sluggishness. Excessive quality, such as too fine bone, narrowness, and lack of depth, often denote weakness and lack of muscular development. Quality carried to this degree is highly objectionable, and should be severely criticized.

Color—The color and color markings are determined largely according to breed. The more common colors are bay, black, gray, brown, chestnut, sorrel, and roan, with some variations. The solid colors are generally preferred, since horses of solid colors are easier to match than those with freakish markings about the head and the legs.

Action—The walk is the common gait of the draft horse, and the one at which he does most of his work. The horse should walk with a long, smooth stride. He should lift his feet from the ground with snappy action, and should flex the joints so that the shoes show plainly. He should then pass the feet forward in a straight line and place them on the ground so that the heels land slightly before the toes and with a good firm grip. This does away with the short, stubby gait that is noticeable in many horses when they land the toes on the ground first and slide them along for a very short distance, pushing up dirt ahead of them.

The action at the trot should be practically the same as at the walk; that is, it should be rapid, straight, and regular. Any defects of the gait at the walk will be more easily detected at the trot, and it is for this reason, largely, that the draft horse is judged at the trot. In order to show his action, the draft horse should be led directly away from, then back toward the judge, and past him. In this way the horse's action in going, coming, and passing, may be noted.

The more noticeable defects in the gait of the draft horse are usually reflected in his conformation. Thus the horse with a short neck and a heavy head usually has a short stilted action; one with thick withers and a wide chest often wings his feet outward; one that stands too wide in front usually has a wide, straddling action; the knock-kneed horse has a winging action; the horse that stands with his toes pointing inward as a rule wings his feet outward; and the horse that stands with his toes pointing outward generally wings his feet inward as he travels.

Temperament—The draft horse should have a lively, energetic, and intelligent disposition. He should be a ready and a willing worker, without being irritable and nervous. He should be neither sluggish nor excessively nervous. A sluggish disposition is indicated by indifference and lack of poise, and should be guarded against. The excessively nervous horse should also be guarded against, as he will not make so good a worker nor last so long as will the more docile animal.

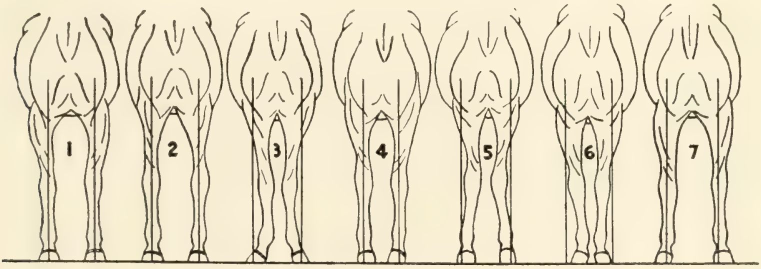


Plate I.—Front View of Fore Limbs

A perpendicular line drawn downward from the point of shoulder should fall upon the center of the knee, cannon, pastern, and foot.

Cut 1—Represents the correct conformation. Cuts 2 to 7, inclusive, represent common defects. Cut 2—Slightly bow-legged. Cut 3—Close at knees and toes out. Cut 4—Toes in. Cut 5—Knock-kneed. Cut 6—Base narrow. Cut 7—Base wide.

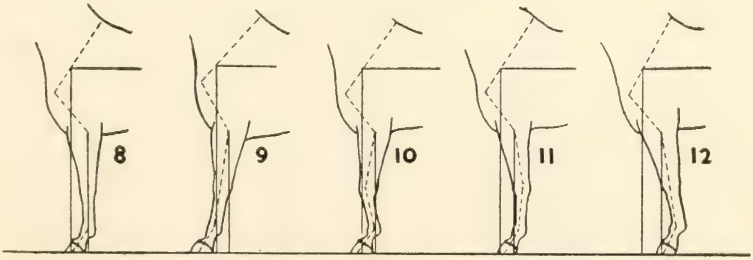


Plate II.—Side View of Fore Limbs

A perpendicular line drawn downward from the center of the elbow point should fall upon the center of the knee and pastern, and back of the foot, and a perpendicular line drawn downward from the middle of the arm should fall upon the center of the foot.

Cut 8—Represents the right conformation. Cut 9—Leg too far forward. Cut 10—Knee sprung. Cut 11—Calf kneed. Cut 12—Foot and leg placed too far back.

Figure 21, Front and side view of the fore limbs

Attitude—By attitude is meant the position of the legs in respect to the ground and the body. The legs should be vertical and well set on the body. When viewed from the front, the legs should be straight so that a line dropped from the point of the shoulder will pass over the center of the knee and the center of the ankle, and come to the center of the toe. Some of the common deviations from this are the turning in or out of the toes and the bending in or out of the knees, so that the line passes either side of the center. When viewed from the side, the front legs should be straight so that a line dropped from the center of the shoulder blade will touch the center of the forearm and the center of the side of the hoof, and be parallel with the bones of the leg. Common deviations from this are the placing of the legs too far under the horse, "buck knees" or knee-sprung, when they project too far forward, and "calf-knees," when the knees tend to spring backward.

When viewed from the rear, the hind legs should also be vertical, so that a line dropped from the point of the buttock will pass over the center of the hock, down the center of the cannon and the ankle, and cut over the center of the heel. Common deviations are the turning in or out of the toes or of the hocks. When viewed from the side, the hind legs should be perpendicular, and a line dropped from the thurl should pass over the center of the gaskin, down parallel to the cannon, and touch the center of the side of the foot. Also a line dropped from the

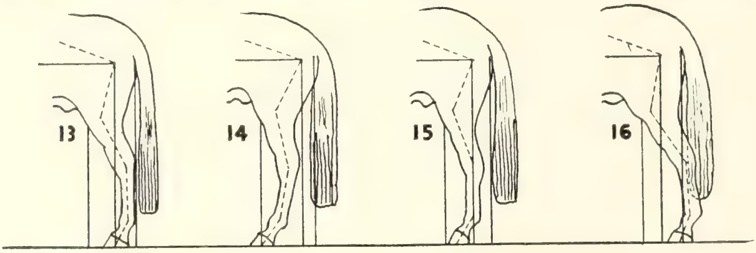


Plate III.—Side View of Hind Limbs

A perpendicular line drawn downward from the hip point should fall upon the center of the foot and divide the gaskin in the middle; and a perpendicular line drawn from the point of the buttock should just touch the upper rear point of the hock and fall barely behind the rear line of the cannon and fetlock. Correct position of the leg from this view is most important in a horse.

Fig. 13—Represents the correct conformation. Fig. 14—Leg too far forward and hock crooked. Fig. 15—Entire leg too far under and weak below hock. Fig. 16—Entire leg placed too far backward.

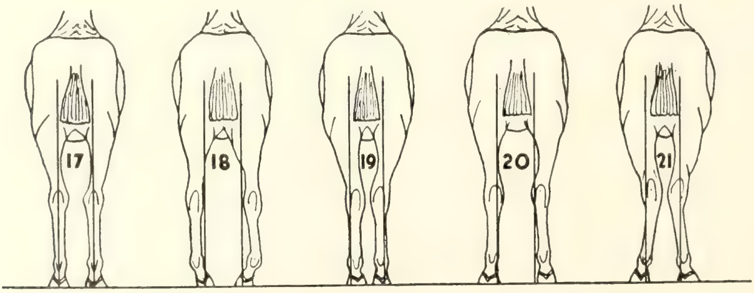


Plate IV.—Rear View of Hind Limbs

A perpendicular line drawn downward from the point of the buttocks should fall in line with the center of the hock, cannon, pastern and foot.

Cut 17—Represents the correct conformation. Cut 18—Bow-legged. Cut 19—Base narrow. Cut 20—Base wide. Cut 21—Cow-hocked and toes out.—Very serious fault.

Figure 22, Side and rear view of hind limbs

buttocks should touch the hocks and pass down back of the cannon and the ankle, touching all the way down, and meet the ground a few inches back of the heel. Common deviations are too curved hocks with feet too far under the horse known as "sickle hocks"; or the feet and the legs may extend too far back and not be under the horse; or both feet and legs may be too straight and too far under the horse.

Head—The head should be fairly large, and in proportion to the rest of the body. It should be lean, and the features should be clean-cut. The front of the head should be straight. The forehead should be broad, a little more than one-third the length of the head. The depth of the head should be about one-half the length of the head. The length of the head should be about two-fifths the height at the withers.

Neck—The neck of the draft horse should be of medium length and heavily muscled, but should not be thick. It should be slightly arched on top, and should have mane of good quality. The windpipe should be large for this indicates good breathing power. The neck should be smoothly and neatly attached at the shoulders in such a way that the horse can get his head up. The length of insertion should be about equal to the length of the underline. The neck should be free from all coarseness or thickness at the throatlatch, and should fit neatly into the head. Coarseness or thickness at the throatlatch may cause pressure on the windpipe when the horse is checked up, and thus make the breathing thick and heavy.

2. Body

Withers—The withers should be well placed, blending smoothly with the neck and back, as well as giving direction to the shoulder. In the draft horse they should be neither too wide nor too prominent, since these faults expose them to injury from the collar.

Shoulders—The shoulders should be moderately sloping, extending into the back, and smoothly covered with muscle to form a cushion for the collar. The distance from the point of the shoulder to the point of the withers should be slightly shorter than the length of the head. The shoulders should be free from all coarseness, roughness, sores, or tumors. The withers should be well covered and moderately high. The majority of poorly formed shoulders in draft horses are too vertical, although the other extreme too sloping shoulders, may also be found. These often cause collar trouble when the horse is doing heavy work.

Arms—The arms extend from the point of the shoulder to the elbow, and in draft horses it should be relatively short, heavily muscled, and well set. The elbows should be clean and prominent and carried neither too close to the body nor too far from it, for if carried in either of these ways the horse will tend to have a rolling or a sprawling action.

Chest—The chest should be wide and deep, thus giving plenty of room for the development of the heart and lungs. When viewed from the front, there should be good width between the legs, and the breast should be low and level. The heart girth is the circumference of the chest just back of the shoulders. It should be largely due to the spring of the ribs and to depth, which should be about one-half the height of the horse. The large girth should not be caused by excessive fat over the ribs. A large, wide, deep chest denotes vigor, power, and strong constitution, while a shallow, narrow chest denotes the opposite, or poor constitution, lack of endurance, and deficient breathing organs.

Ribs—The ribs form the frame for the barrel, or body, of the horse. They should spring from the backbone in a bold curve and should be long, thus forming a wide, deep barrel. The ribs should be fairly wide apart, and the last, or rear, ribs should be of good length and should extend back close to the hip, giving a deep, full flank. Well-sprung ribs and a rounded barrel are indicative of good digestive organs and ability to do hard work. Lack of spring of ribs and short rear ribs with tucked-up flank are indications of weakness, poor digestion, lack of appetite, and a horse generally hard to keep.

Back—The back extends from the rear of the withers through the last rib, and should be short, straight, broad, and muscular. One should not mistake excessive fat along the back for heavy muscling. Since practically all the power is developed in the hind legs and is transmitted through the back to the shoulder and the collar, it is important that the back should be straight, strong, and short.

Loin—The loin is that region of the back that extends from the last ribs to the hips. In other words, it couples the body to the hips. It should be short, broad, strong, and heavily muscled. The loin of the female should be a little longer than that of the male. In judging a broad, well-muscled loin, care should be taken that fat is not mistaken for muscle.

Underline—The underline should be long, low, and straight. Both the foreflank and the rear flank should extend well down so as to give a straight line. Lightness or tucked-up flanks show a tendency to lack constitutional vigor.

Hips—The hips should be wide, level, and well covered with muscle, as this gives the required strength and also protects the hips from injury. Roughness across the hips, with prominent hip bones, is undesirable, for it shows a lack of quality, and rough, prominent hip bones are more susceptible to injury.

Croup—The croup extends from the rear of the loin to the insertion of the tail. The croup should be fairly level, of good length, wide, and well muscled. The croup should not be perfectly level, but should slope a little. Some of the most common faults are the very sloping croup and the lack of muscular development.

3. Fore Legs and Feet

Forearms—The forearm extends from the elbow to the knee, and should be of fair length. It is made up of the humerous, which is heavily muscled around the upper half but is clean, cordy, and flat on the lower half, just above the knee. Here and in the gaskin are probably the best places to determine the approximate strength of a horse as these two parts are entirely bone and muscle, and will not take on fat as will the back and the loin or other parts of the horse.

Knees—The knees should be clean-cut, well formed, and with good width and depth. They should be vertical when viewed from the side, bending neither backward, known as "calf knees", nor forward, known as "buck knees", or kneesprung. The knees should be well supported. The knees cannot well be too large if they are clear of fleshiness and well formed and supported. Any blemishes or scars around the knees should be guarded against, for they are sure signs of weak knees.

Cannons—The cannons extend from the knees to the fetlocks, and are composed chiefly of bones and tendons. They should be short, clean, wide, and flat when viewed from the side. The flat appearance should be due to the well-detached tendon in the rear. This tendon should not be tucked in just below the knee. If long hair, or feather, as it is commonly called is found springing from the back of the tendon, it should be fine and silky and not coarse and curly, as the coarseness is an indication of coarse bone and flesh on the cannon. The cannons should be examined for bony bunches or splints, just under the knees, which may cause the horse to be lame, and also for any little bunch along the side of the cannon, which may show that the horse interferes high on the cannon.

Fetlocks—The fetlocks should be wide, deep, clean, and free from all puffiness. They should be straight, strong, and well supported. Any sores or calluses caused by interferring, knuckling, or breaking forward, are highly objectionable. At the back of the fetlocks, in the hair, is a horny projection known as the ergot. This is inclined to be large and prominent in many draft horses.

Pasterns—The pastern is between the fetlock and the foot. It should be of medium length, clean, strong, and should support the fetlock joint well. The line showing the slope of the pastern should meet the ground at an angle of about forty-five degrees. The distance from the fetlock to the ground should be about 7 to 8 inches. Pasterns that are too upright and short give the horse a short, stubby gait and also cause various foot troubles and unsoundness. Too sloping pasterns are indicative of weakness, and will generally break down with age or when the horse is put under the strain of hard work for any considerable length of time.

Feet—The foot should be so placed on the pastern that it toes straight ahead and does not turn in or out, for this tends to make the horse either "wing" or paddle. When viewed from the front, the feet should be about as far apart as the width of one of the feet. They should also be practically round with a little sharper turn in on the inside of the toe and more nearly straight to the inside rear quarter. When viewed from the side, the median line of the toe should be parallel to the heel. The median line should meet the ground at an angle of about fifty degrees. The length of the median line on the toe should be about twice the height of the heel. The surface of the foot should be smooth and free from all vertical cracks and ridges or wrinkles extending around the foot.

The foot should be waxy in appearance, and should show density. The horn should be dark colored and neither brittle or shelly. The bottom of the foot should be concave. The heels should be broad throughout its length, widening somewhat as it reaches the sole. The frog, which is the soft, spongy, triangular piece extending from the heel to the center of the foot, should be large, well defined, and soft or elastic to the touch. Frogs that are hard, dry, decaying, or shrunken and cracked open at the center are in a serious condition which should be guarded against. The bars should be well defined, healthy, and strong, since they keep the heel from contracting.

Hoof—When making contact with the ground, the hoof expands, especially at the heel. Likewise, when the weight is relieved as the hoof is raised, it contracts. The hoof is so constructed to break the shock and to absorb concussion. This is significant, for the legs, especially the feet, pasterns, and hocks, are subject to extra strain in locomotion. Because of the pounding to which these parts are subjected, they are exposed to injury, resulting in unsoundness. Special attention should be given them in passing judgment upon the value of a horse.

4. Hind Legs and Feet

Thighs—The thighs, extending from the hips to the stifles, should be strongly muscled, wide, and long. It is most highly important that the thighs should be well muscled, as it is through these muscles that the horse gets most of his power to pull.

Stifle Joints—The stifle joint should be strong, well muscled, with a marked depression both above and below the patella, clean-cut in front, and free from all swelling. The stifle should be close to the abdomen with very slight deviation outward to allow straight, smooth, long, free action in the rear legs.

Buttocks—Viewed from the rear, the buttocks are the heavy muscles on the inner sides of the thighs. They should be full, thick, and carried well down to the gaskin. It is a serious defect in a horse to be light muscled through the buttocks.

Gaskins—The gaskin is the region between the stifle and the hock. It should be heavily muscled near the stifle but lightly muscled near the hock in a way similar to the forearm in the front leg. This is one of the regions in which to determine the muscling of a fat horse, for this region cannot be covered with fat. The gaskins correspond to the forearms, and what is true of one is equally true of the other.

Hocks—The hock is the most important joint of the animal's body, for it is through this that he pushes or pulls his entire load. The shape, the strength, and the soundness of the hock can best be seen from a position in line with the horse's head and a little to one side. From this position the face, or inside, of the hock can be seen; it should be broad, flat, clean and well supported below by the cannon bone. The cannon should appear strong and not tucked in below the hock. The hock should then be examined from side and back. It should be long from top to bottom, angular, strong, sharply defined, and well supported on the back by the tendon. The hock should be clean and free from all puffiness. The hocks should not be too close together, neither should they be too far apart; but they should be placed that a plumb line dropped from the point of the buttocks will pass over the center of the hock and down back of the cannon, touching the cannon all the way down. Too curved hocks or "sickle" hocks, are signs of weakness, and generally produce curbs due to strain on the parts.

Cannons—What has been said of the cannon of the fore leg is equally true of the cannon of the hind leg, except that the cannon of the hind leg is slightly longer, being from 11 to 12 inches long. The cannon should be clean, with a flat appearance due to the detached tendon, and should not be light or cut in just below the hock.

Fetlocks—The statements made about the front fetlocks are equally true of the rear fetlocks. They should be clean and free from all puffiness. Puffiness about the rear fetlocks is a most common defect in horses.

Pasterns—All that has been said of the pasterns of the front legs hold true for those of the hind legs, except that the line showing the slope should meet the ground at an angle of about sixty degrees.

Feet—The quality of the hind feet should be the same as that of the front feet. The hind feet should not be quite so round as the front feet, their walls should be a little more vertical, and the heels should be a little higher and separated a little more than those of the front feet. The hind feet should be more concave than the front feet, and the frog and bars should be prominent and in good condition.

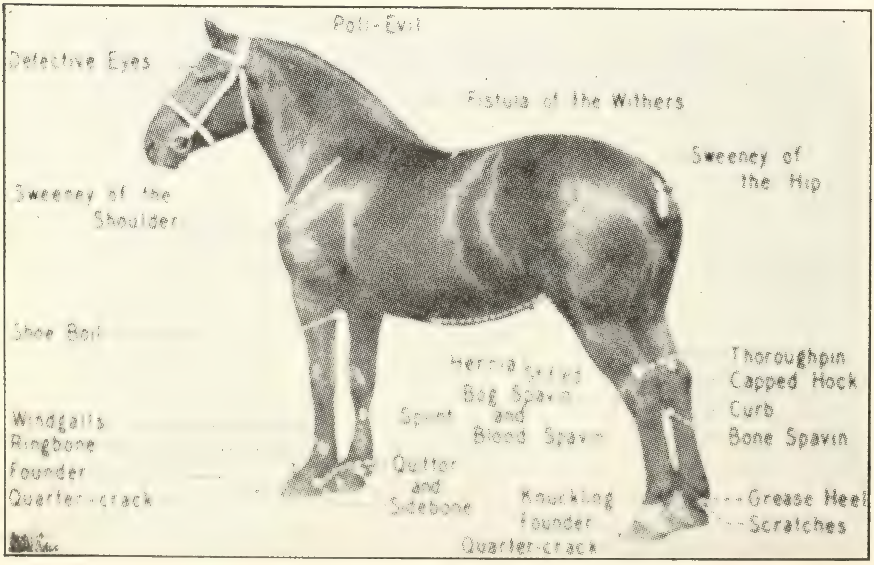

Poll-Evil
Defective Eyes
Fistula of the Withers
Sweeney of the Hip
Sweeney of the Shoulder
Shoe Boil
Thoroughpin
Capped Hock
Curb
Bone Spavin
Bog Spavin
and
Blood Spavin
Splint
Windgalls
Ringbone
Founder
Quarter-crack
Quittor
and
Sidebone
Knuckling
Founder
Quarter-crack
Grease Heel
Scratches

Figure 23, Location of common unsoundnesses and blemishes

The Common Unsoundness of Horses and Mules

The horse buyer and judge must be familiar with common unsoundnesses in order to evaluate a horse properly. The following illustrations show the location and effect of a number of these unsoundnesses:

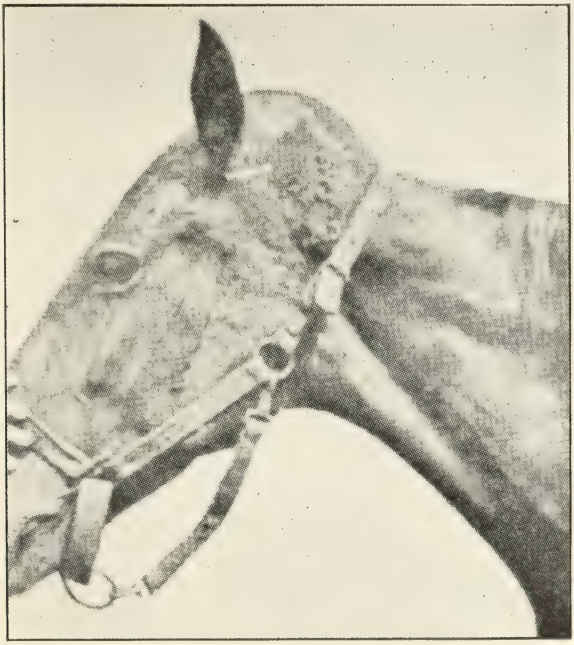


Figure 24, Poll-evil

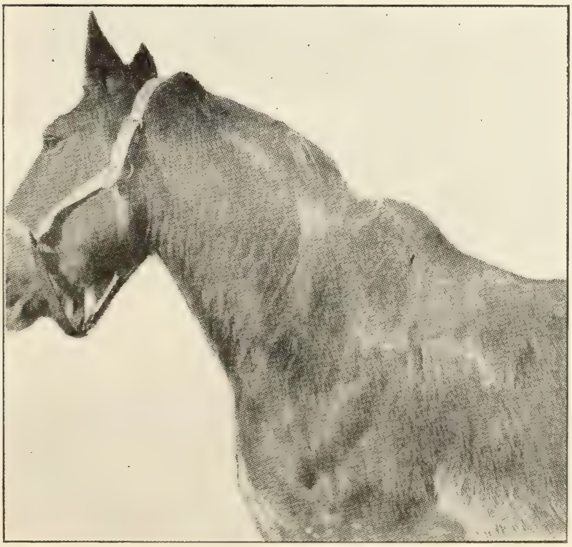


Figure 25, Fistula of the withers

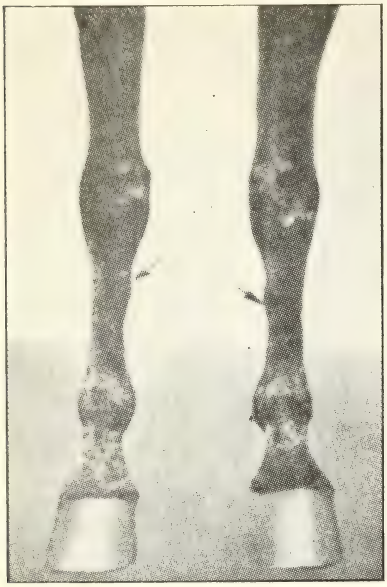


Figure 26, Splints

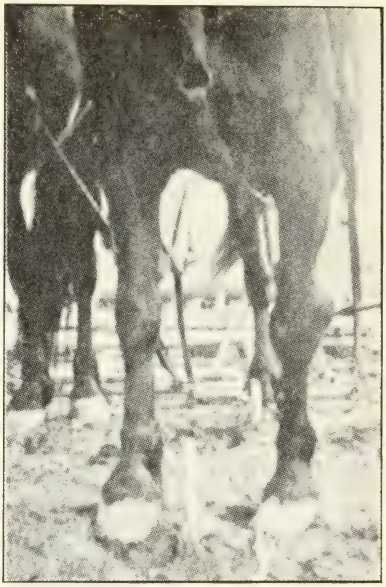


Figure 27, Wind galls

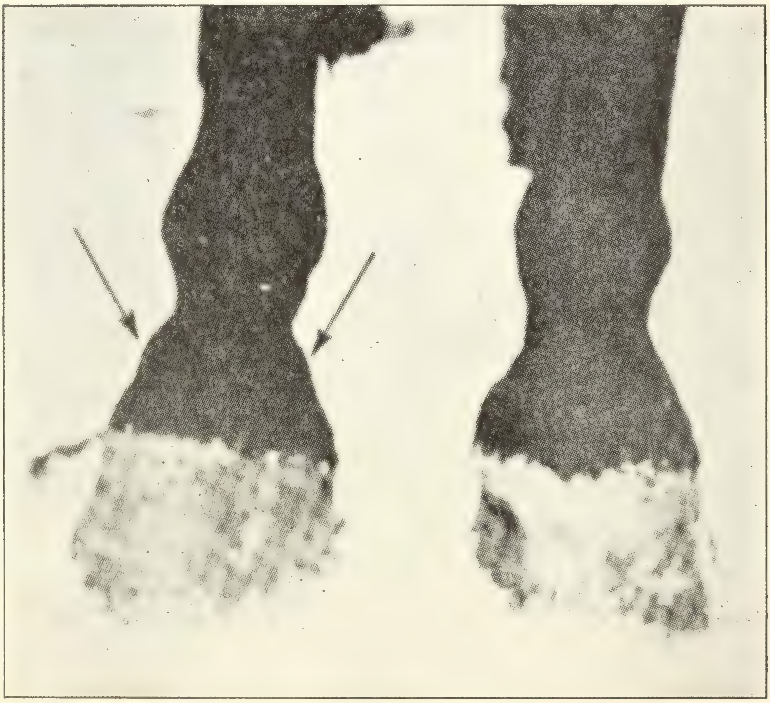


Figure 28, Ringbone on the bones of the pasterns

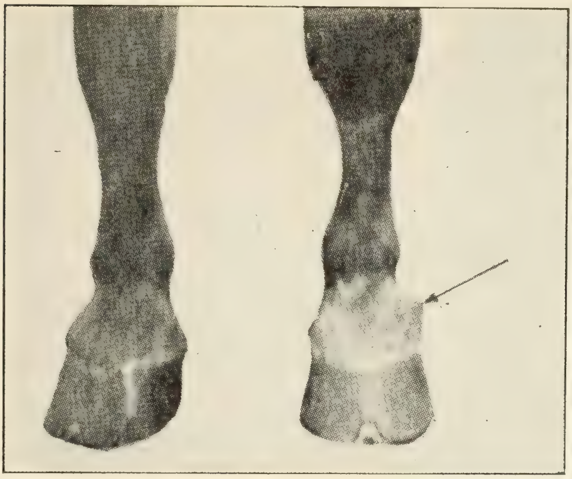


Figure 29, A sidebone

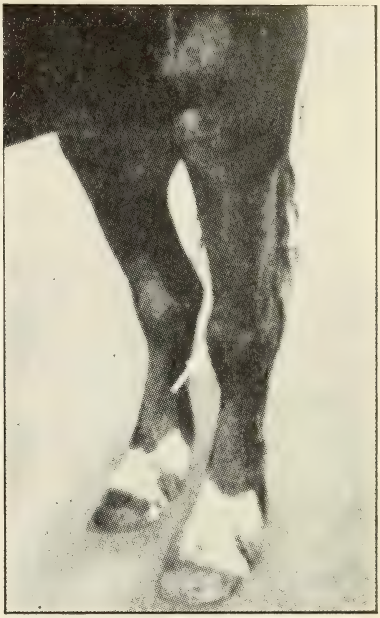


Figure 31, Bog Spavin

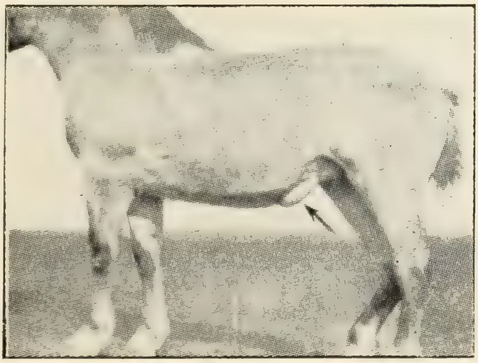


Figure 30, Unilical hernia

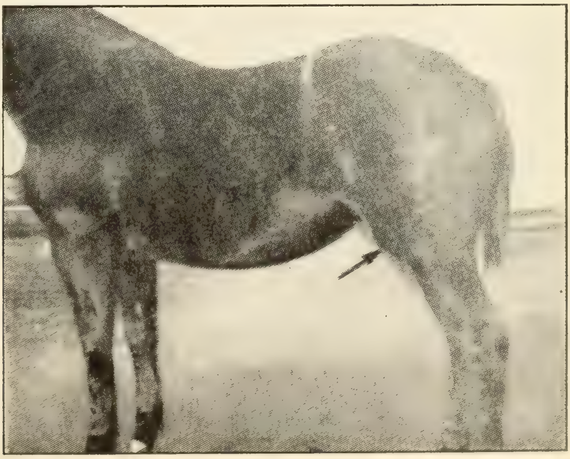


Figure 32, Stifled

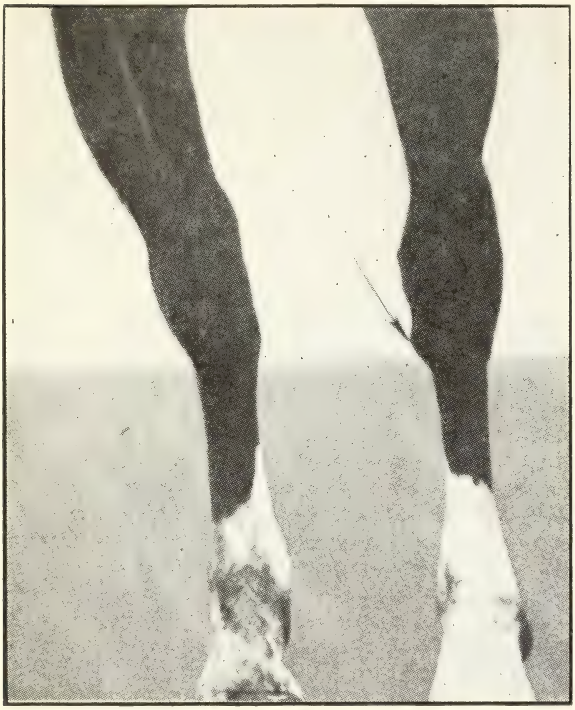


Figure 34, Bone Spavin

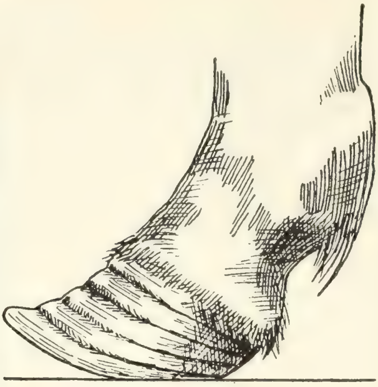


Figure 33, Foundered hoof

The Breeds of Horses

Type	Breed
Draft	Percheron
	Shire
	Clydesdale
	Belgian
	Suffolk
Light	Thoroughbred
	Standardbred
	American Saddle
Carriage	German Coach
	French Coach
	Cleveland Bay
	Hackney
Ponies	Welch
	Shetland
	Hackney

Draft Horses

There are five main breeds of draft horses, namely: Percheron, Belgian, Clydesdale, Shire and Suffolk.

Percheron

The Percheron horse originated in LaPerche, France. They are now bred and used extensively in America.

Color—The color is gray and black, with a small number bay or brown.

Size—The size varies from 1,500 to 2,000 pounds. The height ranges from 16 to 17 hands, as a rule.

Conformation—The Percheron has a refined head and neck, and a clean bone of good quality. The best specimens are short of back and long underneath. Tail is set fairly high, with the carriage of head and neck gives an attractive appearance. The legs show strength of bone and the feet have good size and texture.

Action—The Percheron is the most active of all of the draft breeds. The walk and trot are snappy and elastic.

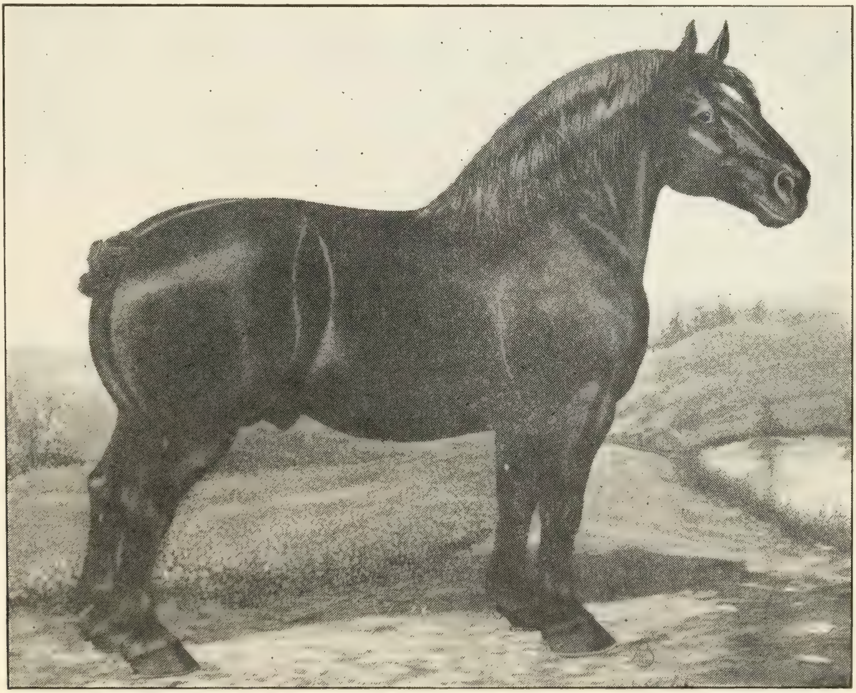


Figure 35, Percheron

Shire

The Shire horse originated in Cambridge and Lincolnshire, England.

Color—Black, bay, chestnut, roan and gray can be found in the breed. They have a greater variety of colors than any other draft horse. Bay, with the white or roan markings, is perhaps the color most often found.

Size—The Shire is a very large, heavy horse, the weight ranging from 1,700 to 2,200 pounds. In height, the Shire varies from 16 to 17½ hands.

Conformation—The breed is extreme of scale, head and neck massive, barrel long and full, with heavy quarters. The bone is very large and round, and the hoof of a somewhat shelly texture. The legs in the rear below the hock and knee have a coarse, long hair, called "feather".

Action—Owing to his size he is sluggish in movement.

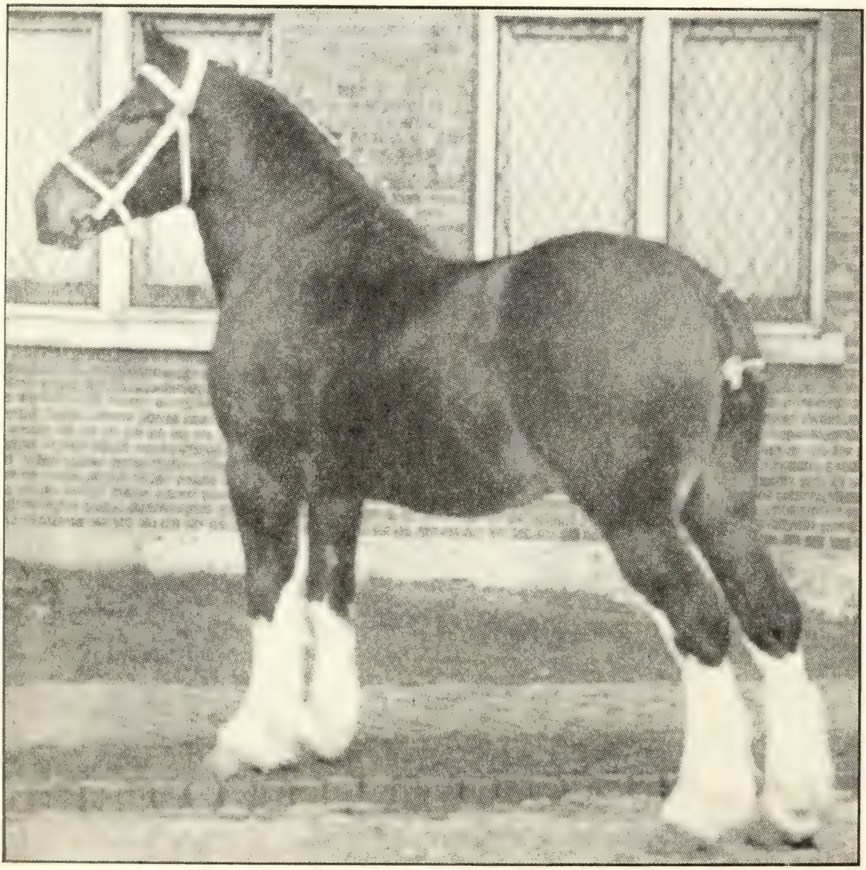


Figure 36, Shire

Clydesdale

The Clydesdale horse originated in the valley of the River Clyde, in Scotland. From this territory they were imported into America and are being produced in considerable numbers.

Color—The popular colors are bays and brown, but gray, black, chestnut and roan are found. As with the Shire, to which they are related, white markings are common. Often too, much white is found in the form of splashes on the body and, frequently, above the knee and hock.

Size—The Clydesdale is not so massive as the Shire, yet he is of greater scale than the Percheron. The weight ranges from 1,600 to 2,000 pounds. The average height is near 16½ hands.

Conformation—The Clydesdale does not have so attractive a head as some other draft breeds; nor is the barrel so full and compact as breeders desire, but the shoulder is long and sloping and the croup is broad and level. It is claimed for the Clydesdale horse that his legs and feet are superior to those of other draft breeds. The pasterns are long and sloping and the rear of the cannon bones shows abundance of long, fine hair or "feather".

Action—The one surpassing quality of the breed is its action. The stride is straight and sprightly. The hocks are kept well together in both walking and trotting.

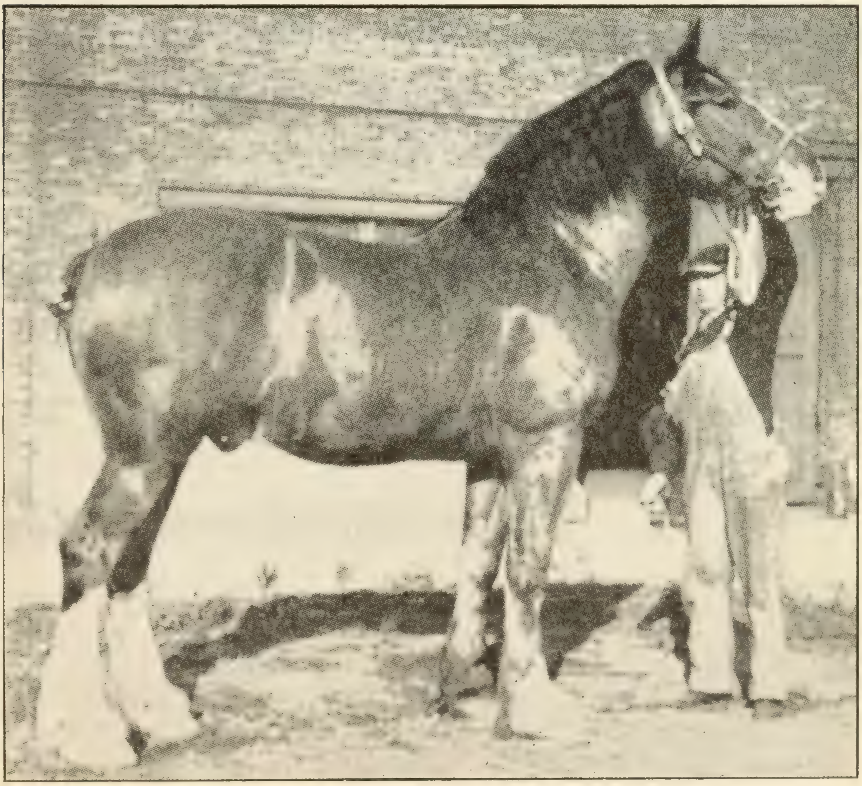


Figure 37, Clydesdale

Belgian

The Belgian horse originated in Belgium from Flemish horse ancestry.

Color—Roan and chestnut are the two colors most frequently found in the breed, but all the other colors are possible.

Size—In size the Belgian ranks next to the Shire. The height is about 16 hands, and the weight of the best specimens goes to 2,000 pounds.

Conformation—The head is medium in size, and the neck is short and heavy. The barrel is wide and closely coupled and the legs are short. The bone is inclined to be round and refined, and the feet are small. Perhaps the greatest fault of the breed is too steep a croup, although breeders are striving successfully to correct the defect.

Action—Owing to the width of the Belgian horses they are inclined to roll or paddle at the walk. The trot, however, is fairly true and rapid.

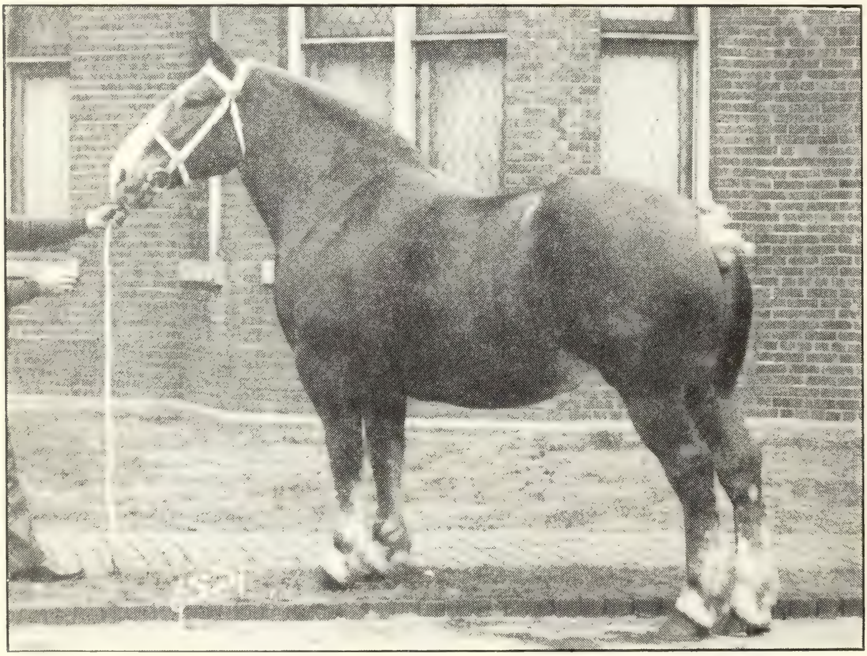


Figure 38, Belgian

Suffolk

The Suffolk horse originated in Suffolk County, England, the entire breed springing from the Crisp horse of Ufford, foaled in 1768. The number in America is not large.

Color—All Suffolk horses are chestnut in color. No other breed of horses is uniform in color.

Size—The Suffolk is a horse of medium size, being the smallest of the five breeds of draft horses. The height is from 16 to 16½ hands, and the weight up to 1,800 Pounds.

Conformation—The head is heavy and the neck short, thick and arched. The barrel is short, deep and thick. One fault of the breed is that the body is too compact. The legs are well set. The bone is clean and not so heavy as in other breeds.

Action—Their action is straight and true, with more rapidity of movement than is exhibited by the heavier draft breeds.

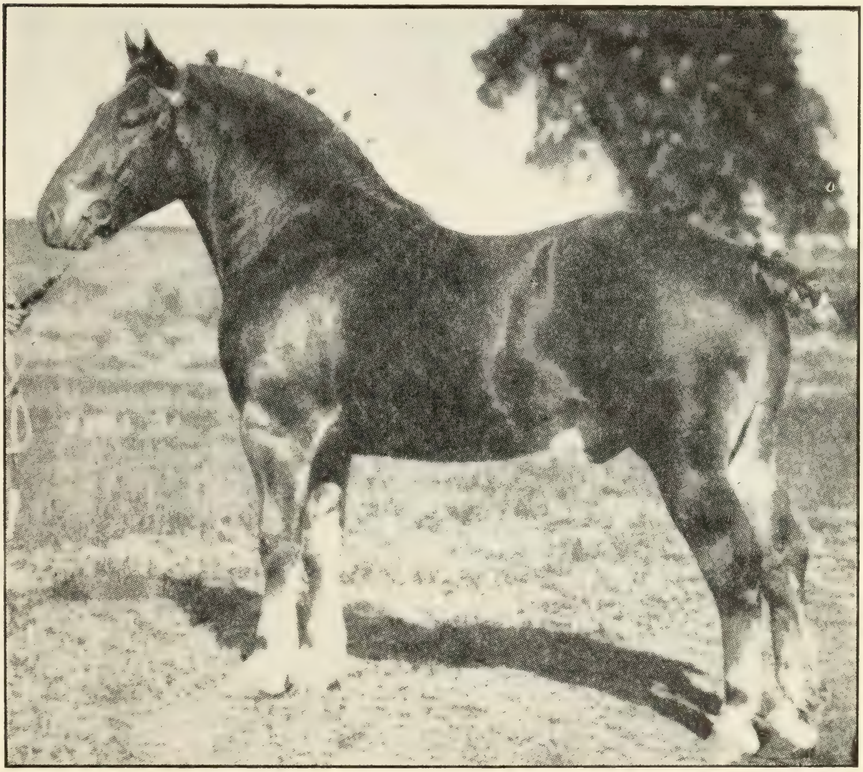


Figure 39, Suffolk Stallion

Light Horses

There are three breeds of light horses, Thoroughbred, Standardbred and American Saddle.

Thoroughbred

Origin—The Thoroughbred originated in England about two hundred years ago. The breed was developed to meet the demand for a race horse and is the oldest and the best bred of all breeds of domestic animals. The Thoroughbred was early introduced into America and the blood has been used extensively in improving the light horses for farm use.

Color—Bay, black and chestnut are the usual colors. Gray and roan are not often seen.

Size—The best families of the Thoroughbred are close to 16 hands in height and weigh in good flesh 1,100 to 1,200 pounds; but many strains are 15 to 15.2 hands and only weigh from 950 to 1,050 pounds. Size is not so important as speed.

Conformation—The head and neck of the Thoroughbred denote refinement. The large, clear eye with its prominence and intelligent expression is always attractive. The neck is long and arched and rises out of sharp, neatly turned withers. The top line of the barrel is short in the best specimens. The coupling is close and ribs well sprung. The croup should be level and the quarters straight. From the standpoint of the show ring the most serious fault of the breed is the too great length of leg, due in large measure to the fact that for 200 years the Thoroughbred has been selected to run fast.

Action—The Thoroughbred has three natural gaits: walk, trot and gallop. The trot is neglected in his training and no attention is given to his walk, but at the running gait he is the swiftest of all animals. The best record for a mile is 1:34 2/5 (1 minute, 34 2/5 seconds).

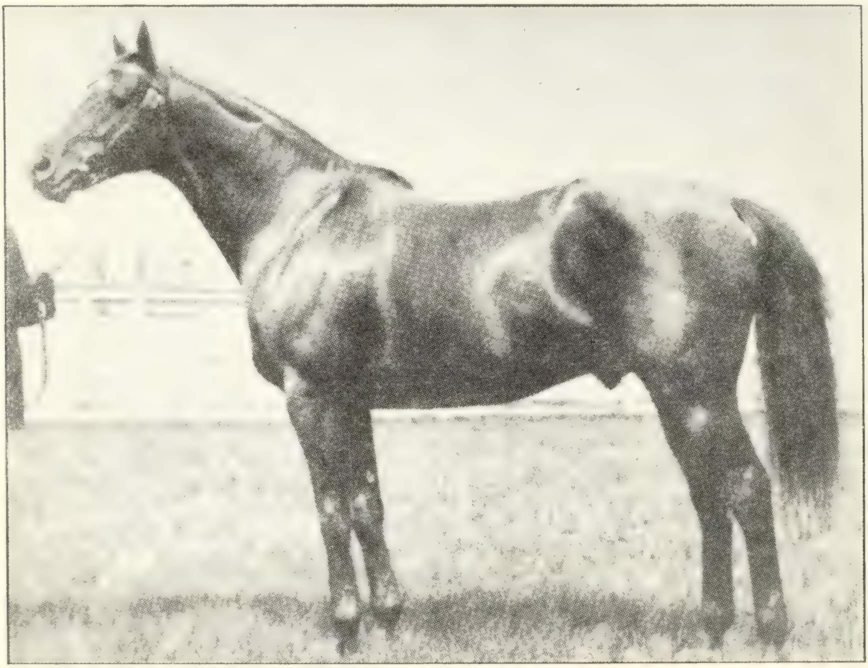


Figure 40, Thoroughbred

Standardbred

Origin—The Standardbred, or trotting horse, originated in America and most of them trace back in their lineage to Hambletonian 10, who is the founder of the breed. He was foaled in 1849 and the breed has been developed since that date.

Color—All the colors, chestnut, black, bay, roan and gray, appear in the breed and possibly even dun. Chestnut, black and bay are the most fashionable colors.

Size—The Standardbred ranges from 15 to 16 hands in height, and from 900 to 1,200 pounds in weight.

Conformation—The Standardbred is the plainest of the breeds of light horses. The breed is not old and has been bred for speed at the trot and pace,

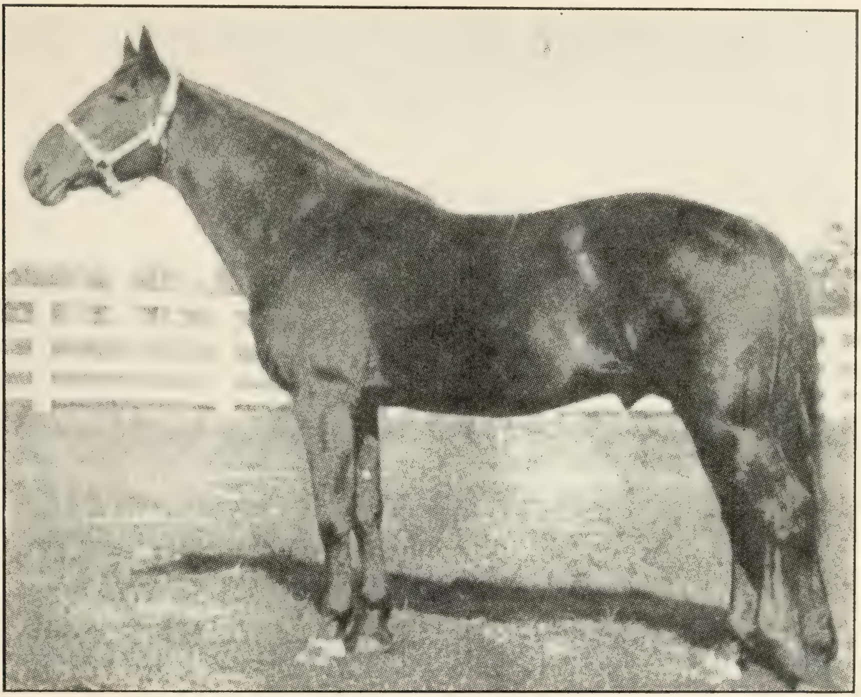


Figure 41, Standardbred

with little effort given to refinement. The head is plain, and the neck is not greatly arched. As a rule the back is short and the underline is long. There is breadth and strength in the loins. The tail setting varies from the level croup to the sloping one. The quarters and gaskins are strong. The legs may be long, medium or short, but they must not be too short. The bone is hard and durable. The feet are medium in size and the horn is of most excellent quality.

Action—For the trotting families of the Standardbred horse the natural gaits are the walk, trot and gallop. An occasional Standardbred horse is double gaited. He can go at both the trotting and pacing gaits. A few of them are trained to race as trotters, and then trained to race as pacers. As a rule, however, a distinct inclination is shown for one gait or the other.

If the horse shows a disposition to trot he is trained at that gait. Horsemen show a distinct preference for the line-gaited trotting horse. By line-gaited is meant a movement in which the hind feet move in a line with the front feet. When the horse is trotting at great speed the front foot is lifted from the ground so that the rear foot passes some distance beyond where the front one was at the beginning of the stride.

The passing-gaited trotting horse is at a discount. Those horses that have the fault go wide in the rear. The hind legs pass the front ones on the outside. It is a gait without ease or grace of movement.

The trotting horse lifts his knee very high when going fast at the trot and also flexes well his hocks.

Pacing is the gait in which the feet on the same side of the body move forward in unison. It is not in demand as is the trotting gait, but faster records are made by pacing horses than are made by trotting horses.

The American Saddle Horse

Origin—The American Saddle horse originated in Kentucky about 1850, but it was not until 1892 that the American Saddle Horse Breeders' Association was formed.

Color—The American Saddle horses are dun, gray, roan, bay, black and chestnut. Bay and chestnut are the colors most frequently seen. Like the other breeds of light horses, the saddle horses are going to the chestnut color.

Size—The Saddle horse varies from 15 hands to 16 hands in height, and in weight, from 900 to 1,150 pounds. The standard in height is 15.3 hands, and in weight 1,050 pounds.

Conformation—The most perfect specimen of the breeder's art is to be seen in the Saddle horse at his best. The head of this horse is neat and well set on a neck gracefully arched. The top line is short and the under line long. The ribs are well sprung and the coupling short. The croup is level and the tail carried in water-spout fashion. The bone is small but very strong. The tendons are prominent. The pasterns are large with the right slope to give elasticity of movement. The conformation is ideal for strength, speed and beauty.

Action—When seen at his best the saddle horse has an action unique for its gracefulness and ease. The hock is flexed and the knee folds gracefully when he goes at the trot. The three-gaited saddle horse has the gaits: flat-footed walk, trot and canter. The five-gaited horse has, in addition to the three mentioned, the rack and the running walk or, in lieu of the running walk, a slow pace may be allowed.

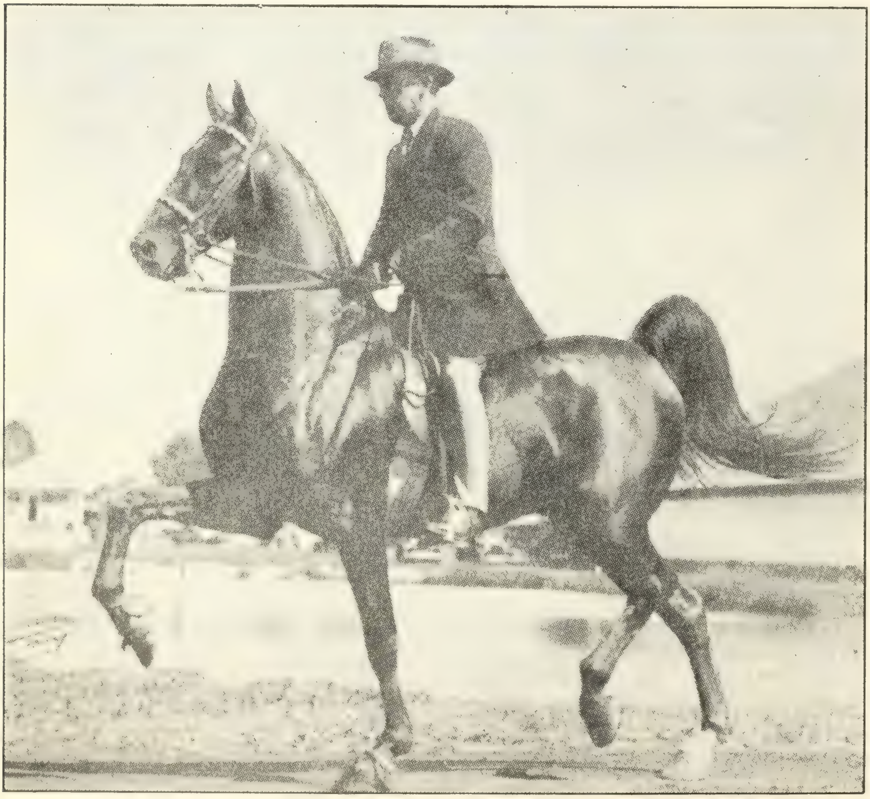


Figure 42, American Saddle Horse

Carriage Horses

There are four breeds of carriage horses, but aside from the Hackney few are bred in America.

The Carriage horse is a large, rangy, upstanding animal, able to go rapidly at the trot. He is larger than the light breeds but not so heavy nor so sluggish as the draft horse.

Some families of the Hackney are small and compact enough for show purposes and are exhibited under the saddle or in fine harness. The prominent feature which they display is the flashy action. Often the fold of the knee is so perfect it is lifted to the body as they go at the trot.

Market Classes of Mules

Mining mules	13 to 15 hands	800 to 1100 pounds
Cotton mules	14 to 15½ hands	850 to 1100 pounds
Sugar mules	15½ to 17 hands	1000 to 1500 pounds
Draft mules	16 to 17 hands	1200 to 1650 pounds
Farm mules	15 to 16 hands	1000 to 1250 pounds

Mining Mules are used in mines to haul coal or other heavy minerals to the shafts. Machinery is rapidly replacing them and the indications are that no mules will be required in mines in the near future. The mining mule is a blocky type, with short legs and a heavy, compact body.

Cotton Mules are used on the cotton plantations of the South and are a light type. There is no set size or type for the cotton farm. Almost any mule will be used if he can do the work and stand the treatment he gets in the hot climate. The essential task of a cotton mule is to cultivate growing cotton. The mule is usually worked by a negro who feeds and cares for him. The mule best suited for

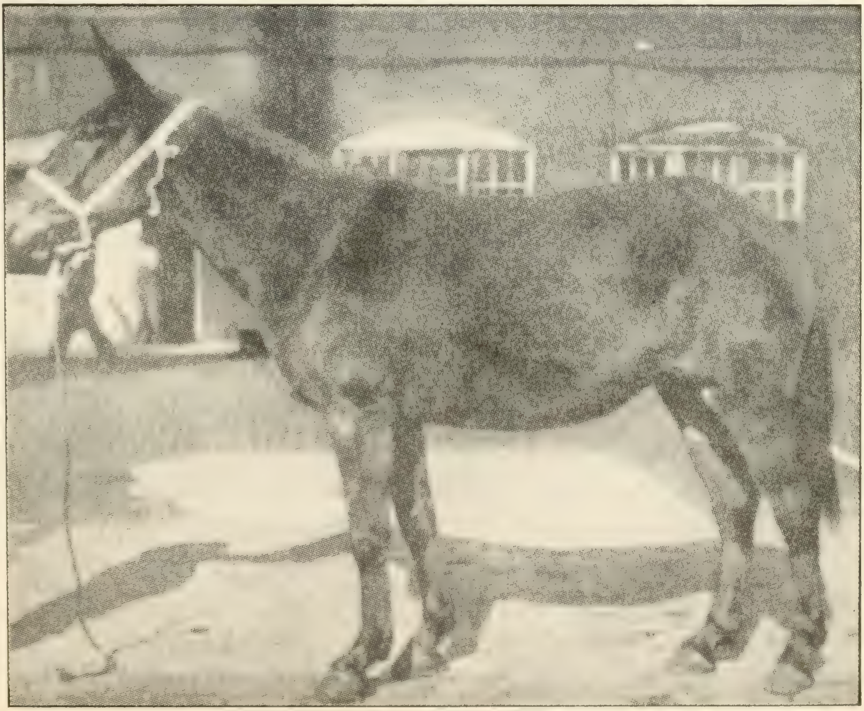


Figure 43, Medium size cotton mule

this work is one out of a light type of mare, and that has an abundance of energy combined with quick movement.

Sugar Mules are used on the large plantations of the South devoted to the production of sugar cane. This work demands a large, heavy, well-finished animal, one that can stand excessive stress and strain. Usually mules selected for this work are sixteen to seventeen hands in height and weigh from 1,200 to 1,400 pounds.

Draft Mules are used for the heaviest work in cities or lumber camps or wherever weight and dependability in the collar are necessary. They do not differ essentially in type from cotton mules except that they may, in some cases, be even larger and have a more stylish appearance. The very largest mules are used for this class and ordinarily the more weight and the greater the style, the better.

In height they go from 16 to 17 hands and in weight up to 1,650 pounds.

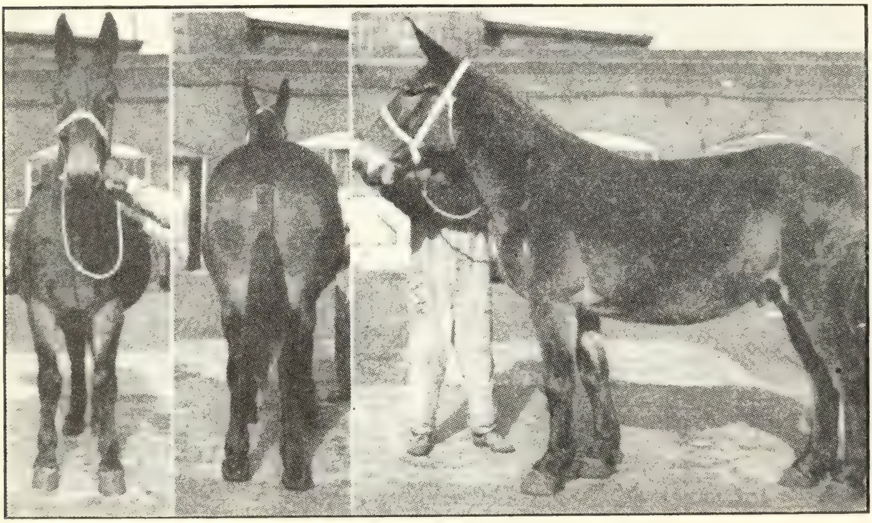


Figure 44, Front and rear and side view of draft mule

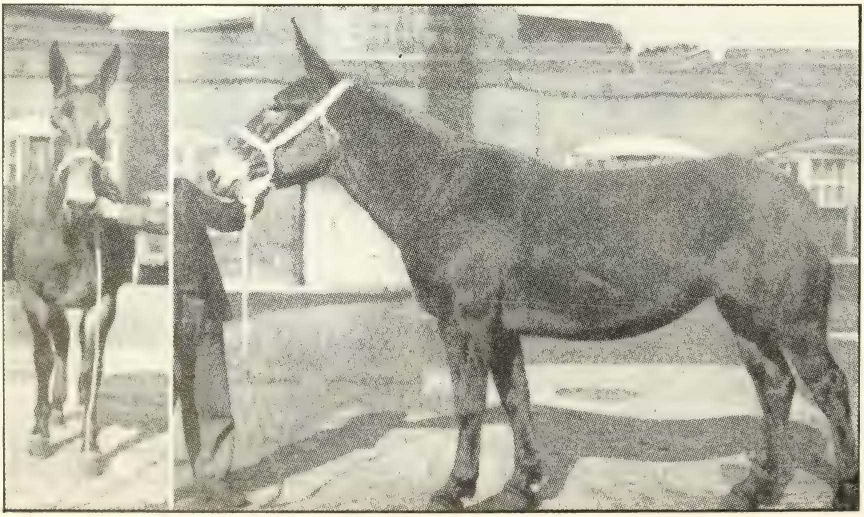


Figure 45, Farm mule

Judging Jacks

In judging Jack stock and in selecting young stock for breeding it is well to consider the size, style, finish and conformation possessed by the young animals. The one that will ultimately make the best mature animal should be selected, not the one that happens to be most mature in form at an early age. The points in detail for mature animals are as follows:

1. **Size**—Jacks and jennets must have plenty of scale. A jack should approximate 15.2 to 15.3 hands, and a jennet 15.1 to 15.2 hands. If the jack is well proportioned and deep in body, 16 hands is a satisfactory height, but tall jacks that lack depth of barrel will sire leggy mules. A sixteen-hand jack should approximate 30 inches in depth of chest, 34 inches in length of foreleg, and should weigh 1,000 to 1,150 pounds.

2. **Barrel**—The shape and size of the barrel are most important. Some jacks shrink perceptibly behind the shoulders and in front of the hips, and such should be relentlessly rejected. A good length of barrel is desirable. The hind flank should be as deep as the fore flank, each approaching 68 to 70 inches in circumference in a jack that is 15.3 hands tall. By all means, the rib should be well sprung. The best breeders abhor a flat, slim jack.

3. **Bone**—The third essential is a big, clean bone. The small, deer-like cannons are not wanted and have no place in the breed of American jack stock. The front cannon should measure from 8½ to 9 inches, half way down from knees to pastern, at the smallest part; and the tape should be drawn tight. The bone should be fluted and clean. Even a 15-hand jack should measure 8½ inches in bone. A 16-hand jack should have a ten-inch rear cannon, while a 15-hand jack should have one at least 9 inches in circumference.

4. **Feet**—The feet should be large, round and dense in texture. Jacks usually have durable, flinty feet, but often they are very contracted, and low at the heel. First-class jacks have large, deep feet with well developed frog and bar.

5. **Head and Ears**—It is customary to refer first of all to the head and ears of jack stock. We have preferred to mention the foregoing points first, because they are really more important, although we appreciate fully that an intelligent looking animal with a fine pair of ears is preferable to any other kind.

The face-lines should be straight or slightly Roman. The ears must approximate 33 inches from tip to tip and be carried alert. The poll between the ears should be narrow, approximately 3 inches in width. Nothing condemns a jack quicker than lop ears. The jack should have a strong jaw and heavily muscled neck, The ewe-neck is not permissible.

6. **Hindquarters**—Unfortunately, jacks are notoriously drooping at the rump, light in thighs and ragged about the hips. The best jacks of today show great improvement in these respects. Also, many jacks are crooked in the hocks; but breeders are rejecting all males and females from their herds that have this defect.

7. **Action**—Jacks and jennets should walk straight and true. The feet should be lifted clear of the ground at each step. Some jacks show considerable speed and flexion when trotting in the paddock. Good action is correlated with quality and proper conformation. A sluggish animal is greatly discriminated against.

8. **Style and Quality**—A jack that holds his ears and head erect and walks proudly commands the respect and admiration of experienced breeders, because they know that such an animal is vigorous, properly formed and that his nervous system is well balanced.

Quality is evidenced by fine, clean bone and silky hair. An animal of fine quality usually shows no evidence of jack sores or other derangements.

9. **Color**—The preferred color is black with white points. The under side of the barrel should be white, and the white should extend between the forelegs and between the thighs. The muzzle should be white also, and in fancy animals there is some white under the throttle and around the eyes. A brownish tinge will not prove a serious detriment, and a black barrel will not debar from the show ring, but a gray jack is at a serious disadvantage in the show ring.

References—Kentucky Extension Service Circular 96, "Fundamentals of Livestock Judging, a Study of Types and Breeds", Lexington, Kentucky.

"Judging Horses and Mules", Horse and Mule Association of America, Chicago, Illinois.

Breed Associations.

JUDGING HOGS

In judging hogs or any other type of livestock the judge should be familiar with the different classes that are judged under each breed. The classes are as follows:

1. Aged Boar, 2 years old and over
2. Senior Yearling Boar, 18 months old and under 24 months
3. Junior Yearling Boar, 12 months old and under 18 months
4. Senior Boar Pig, 5 months old and under 12 months
5. Junior Boar Pig, Under six months
6. Aged Sow, 2 years old and over
7. Senior Yearling Sow, 18 months old and under 24 months
8. Junior Yearling Sow, 12 months old and under 18 months
9. Senior Sow Pig, 6 months old and under 12 months
10. Junior Sow Pig, Under 6 months old

A successful hog grower should be able to judge hogs. To judge hogs requires a great deal of study and practice. The judge should be familiar with the different points of the hogs and how these points should look on an ideal type hog.

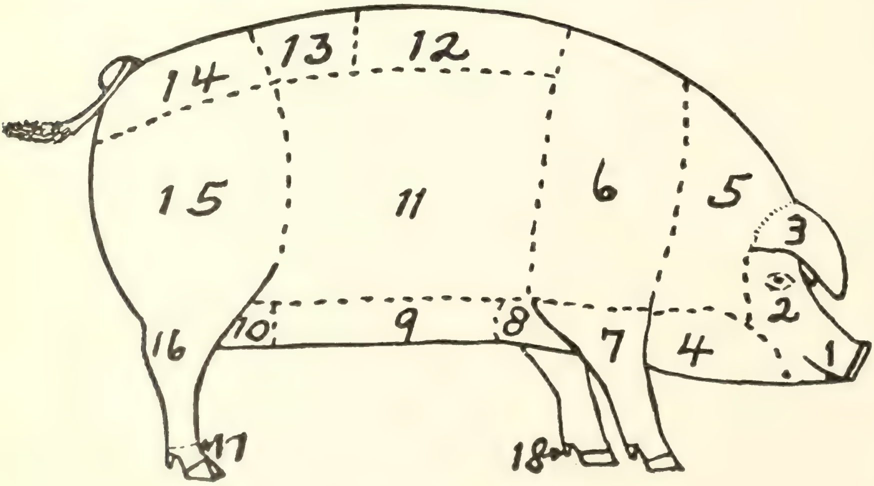


Figure 46, Points of the hog

1. Snout
2. Face
3. Ear
4. Jowl
5. Neck
6. Shoulder
7. Foreleg
8. Foreflank
9. Belly
10. Flank
11. Side
12. Back
13. Loin
14. Rump
15. Ham
16. Hock
17. Pastern
18. Dewclaw

Placing Card for Breeding Swine

Contestant's Number____________ Class________________________

PLACING ON COMPARATIVE POINTS	First	Second	Third	Fourth	Grade
1. General appearance, quality and condition: Size, form, smoothness, activity, breed, and sex characteristics					
2. Head, neck and shoulders: Face, ears, eyes, jowl, and blending of neck and shoulders					
3. Fore quarters (excluding shoulders): Chest, heart girth, forelegs, fore feet					
4. Middle: Back, loin, top, and underlines, sides					
5. Hind quarters: Rump, hams, hind legs, hind feet					
				TOTAL	

(A) Average of the above grades

FINAL PLACING	First	Second	Third	Fourth	Grade
(B) Final Placing Order					

FINAL GRADE: A+B÷2=

There are a number of points that should be considered in judging a class of hogs. The examination of these points should determine the placing of the class on the points as outlined on the score card.

Weight

The lack of proper size for age, is a serious handicap to hogs intended for breeding. With practice in judging will come the ability to ascertain when a hog is sufficiently large for its age. Pigs four months old or older should make a daily gain of from ¾ pound to a pound, from birth. Fat hogs of good quality, weigh from 170 to 250 pounds, ordinarily bring the highest prices on the market.

Form

It is important that the hog have good form. This factor should be observed at a distance from the animal, because the outline and general proportions can be observed best from a distance of ten or fifteen feet. Judges often make their placings in this manner, after which they make detailed examinations of the animals to see whether their first impressions were correct. From in front note the width between the eyes, the smoothness of the shoulder, width and smoothness of back and loin, and straightness and length of front legs. Passing a little to the right note the smoothness and depth of sides, arch of back, and straightness and trimness of underline. A straight-edge applied to the side of the hog, touching the shoulder and the ham, should touch all along the side. Note also the depth of the shoulder and the ham and the length of legs. The common defects noted from the side are a heavy jowl, cut-up flanks, heavy underline, weak back, and drooping rump. From behind observe the symmetry of lines, depth and thickness of hams, and straightness of legs. The ham is one of the most important parts of the fat hog. A hog that stands with his hind legs close together is usually flat and thin in the ham.

The average hog on the Chicago market dresses 70 percent (head on) of carcass to liveweight. A hog of the ideal form if fat, should dress 85 percent. The fat hog is relatively lighter in offal or waste and yields a large proportion of the valuable cuts.

Quality

Good quality in the animal is indicated by fine hair, smooth and pliable skin, an even covering of flesh that is free from lumps and wrinkles, and by clean, straight, strong bone; also, the features will be refined, but not delicate. All these things are indicators of good quality of meat, good health, and general thriftness. The most frequent faults in quality are coarse, heavy head and ears, coarse bone, coarse, curly hair, and wrinkly skin.

Condition

Condition is the degree of fatness. It is most important in determining the selling value of lard hogs. The fat covering should be deep and even, especially along the shoulder, back and loin. High finish guarantees a high dressing percentage and improves the keeping and shipping qualities of the meat when cured. Lack of condition and excessive paunchiness are characteristics of hogs that dress out poorly. The fat hog should be smooth in his covering.

The degree of fatness is indicated by a general plumpness and fullness of form, development of fat in jowl, belly line and hams, and thickness of covering over the shoulder, back, loin and sides. The hand can be used to a limited extent to determine the thickness and mellowness of covering.

Comparative Judging

All show-ring judging is now done by comparison; that is, the score card is not used.

Judging fat hogs is a matter of placing animals according to merit as shown by the four things which indicate dressing percentage and quality of meat, namely weight, form, quality and condition.

Judging Breeding Hogs

The animal used for breeding must in addition to the above mentioned points have a strong constitution, conform to breed type, be strong in feet and legs, and show femininity in the brood sow or masculinity in the boar.

Constitution

The chest of the breeding hog must be broad, full and extend well forward; likewise, the flanks should be full and well let down. These are indications of good constitution, and this, in turn, makes the animal more thrifty, vigorous, and resistant to diseases.

Breed Type

Representative animals of all the lard-type breeds possess the same general form, yet there are differences between the breeds, or variations within the type, that must not be overlooked. The breeding hogs must show all characteristics of the breed to which it belongs. These characteristics can be learned best by carefully studying typical animals of each breed.

Other Important Points

Other points of the breeding hog that must receive careful consideration in judging are, back, and loins, sides, hams and legs. These, of course, must be developed to conform to the type of the breed under consideration. The back should be long, strong, broad, evenly covered with flesh and well arched. The loins, sides and hams furnish the most valuable cuts of meat in the market hog and, therefore, must be well developed in the breeding hog. The legs should be of moderate length, square set and have clean, straight bone of good size and quality. The feet and legs should be of such a character that they will support any weight the hog may attain and yet not show the strain in any way.

Description of Points to be Considered in Judging

The points given below are those considered by judges when judging the show ring, when judging with a score card, and when making selections for the breeding herd.

Head and Face

Duroc-Jersey, Poland China, Chester White, and Spotted Poland China:

Qualifications: Short, good width between eyes, smooth, slightly dished, well tapered down to nose.

Objections: Coarse, narrow between eyes, face straight or decidedly dished.

Berkshire:

Qualifications: Face well dished, snout short and broad.

Objections: Snout long, face too straight.

Hampshire:

Qualifications: Medium length, rather narrow face, nearly straight, medium length.

Objections: Large, coarse, crooked nose or too much dished.

All breeds:

Qualifications: Clear, bright eyes, wide open.

Objections: Small, sight obstructed by wrinkles or fat.

Ears

Duroc-Jersey, Poland China, Spotted Poland China, Chester White:

Qualifications: Medium in size, moderately thin, set well apart, pointed outward and forward, dropped at tip.

Objections: Large or heavy, breaking close to head, obscuring sight, not under control, too rigid or erect.

Hampshire:

Qualifications: Medium length, thin, slightly inclined outward and forward.

Objections: Large, coarse, drooped and not under control.

Berkshire:

Qualifications: Medium size, set well apart, inclined forward, carried fairly erect.

Objections: Large, coarse, drooped.

Neck

Lard breeds:

Qualifications: Short, thick, deep, well set to shoulders, slightly arched. Sows neck not so thick as that of boar. Hampshire should not have neck so thick as other breeds.

Objections: Long, narrow, flat on top.

Jowl

Duroc-Jersey, Poland China, Chester White, Spotted Poland China, and Berkshire:

Qualifications: Broad and full, flesh not hanging too low; fullness carried to point of shoulders.

Objections: Too large, loose flabby, rough, thin, and wedging.

Hampshire:

Qualifications: Light, neat, firm, tapering from neck to point.

Objections: Large, broad, flabby, uneven.

Shoulders

Lard breeds:

Qualifications: Moderately broad, deep, full, smooth, in line with side, not extending above line of back.

Objections: Open, small, extending above line of back, rough, coarse, and shielded.

Chest

All breeds:

Qualifications: Deep, full, and wide, even with shoulders, sides extending down to line of belly.

Objections: Flat, low behind shoulders, tucked in back of forelegs.

Back and Loin

Lard breeds:

Qualifications: Strong, slightly arched, medium breadth, even and smooth from shoulder to ham, full at loin.

Objections: Back low or weak, narrow, uneven, too broad, and flat.

Sides and Ribs

Lard breeds:

Qualifications: Good length, deep, even, and full between shoulders and ham. Ribs well sprung at top and bottom. Sides coming well down to line of belly.

Objections: Sides flat, flabby, creased. Ribs not well sprung, lacking depth.

Belly and Flank

All breeds:

Qualifications: Straight on bottom, carried out full to line of sides. Flank full and let down to line of belly.

Objections: Narrow, tucked up, sagging and flabby.

Ham and Rump

Lard breeds:

Qualifications: Ham, good width full, long, smooth, and fleshed well down to the hocks. Rump, same width as back and slightly rounded from loin to root of tail.

Objections: Hams, narrow, rough, too high in crotch, flabby. Rump, steep, narrow.

Feet and Legs

All breeds:

Qualifications: Legs medium length, set well apart and squarely under body, straight, nicely tapering, well muscled, and of medium size. Feet short in pastern, strong, toes close together.

Objections: Legs extremely long or short, weak, crooked, coarse, close together. Toes long, weak, and spreading.

Tail

All breeds:

Qualifications: Set well up. Medium size, tapering from root to end, inclined to curl.

Objections: Extremely slim or heavy, too long or bobbed.

Coat

All breeds:

Qualifications: Fine, straight, smooth, fairly thick, covering body well except belly.

Objections: Bristles, swirls, coarse, curly, very thin.

Color

Duroc-Jersey and Tamworth:

Qualifications: Cherry or golden red without any mixtures.

Objections: Very dark or very light, black or white spots in hair or on body.

Poland China and Berkshire:

Qualifications: Black with white on feet, nose, tip of tail and occasional spots on body; may show tinge of bronze or copper color.

Objections: Numerous large, white spots on body, or white legs.

Hampshire:

Qualifications: Black with exception of white belt encircling body, including forelegs.

Objections: White high up on hind legs or extending more than one-fourth the length of body, or solid black.

Spotted Poland China:

Qualifications: Black with at least 20 percent of body white, which may be in large or small spots.

Objections: Not white enough on body to meet requirements.

Chester White and Yorkshire:

Qualifications: White (dark spots on skin are objectionable, but do not disqualify).

Objections: Any other color than white in hair.

Action and Style

All breeds:

Qualifications: Active, vigorous, graceful, gentle, and easily handled.

Objections: Awkward and wabbling, clumsy, sluggish.

Condition

All breeds:

Qualifications: Skin smooth and mellow, flesh, evenly distributed over entire body.

Objections: Too fat, skin diseased or harsh to touch, hair coarse and rough.

Disposition

All breeds:

Qualifications: Quiet, gentle, and easily handled.

Objections: Cross, restless, wild, or sluggish.

Symmetry

All breeds:

Qualifications: The adaptation of all points combined to make the desired type of model.

Reference: U. S. Department of Agriculture Farmers' Bulletin 1455, "Fitting, Showing and Judging Hogs", Washington, D. C.

Description of Breeds of Swine

Duroc-Jersey

The Duroc-Jersey breed originated in the northeastern section of the United States. It was derived from mating strains of red hogs developed in sections of New York and New Jersey. Those in New Jersey were originally called Jersey Reds; those in New York are said to have been developed by a man who owned the noted stallion Duroc, and people in that vicinity called the red hogs which this man was breeding "Duroc" hogs. Several years after the independent breeding of Duroc and Jersey Reds, these hogs were intermingled in breeding with the result that there was formed the breed known at the present time as Duroc-Jersey. This breed is red in color, without admixture of any other colors. The popular color is referred to as cherry red; some animals, however, are dark, while others are light. There is no recognizable difference in the feeding or other qualities among hogs of the different shade of color in this breed.

From its early history the Duroc-Jersey was noted for hardiness and prolificacy. It began to be popular in the United States at about the time Poland China breeders were producing the small type of hogs or so-called "hot bloods". This popularity had much to do with making the Duroc-Jersey breed as widespread as it is today. Animals of this breed had sufficient quality and hardiness to make them profitable to hog growers. In type they are similar to big type Poland Chinas. The older boars when in show condition do not as a rule acquire quite so much weight as those of the Poland China breed. The legs are of medium length, with good bone. The sows are prolific and are good milkers and mothers. Duroc-Jerseys are good grazers and are profitably adapted to following cattle in the feed lots.

Pigs of the most desirable type attain a weight of 200 pounds at 6 months of age and are capable of producing a greater weight at a profit if market conditions justify their being fed for a longer time. Boars are massive and have good length and depth with good backs. In show condition they may attain a weight of 1,000 pounds. In breeding condition an aged boar generally weighs from 650 pounds up.

Duroc-Jersey sows generally are upstanding, having good depth with good backs as well as good feet and legs. One seldom finds a sow of this breed cross or fretful. In show condition sows generally weigh from 600 to 700 pounds. In some instances a greater weight is reached.

The association for recording hogs of this breed is the United Duroc Record Association, Peoria, Illinois.

Reference: Farmers' Bulletin 1263, "Breeds of Swine", pages 2, 3, and 4, United States Department of Agriculture, Washington, D. C.

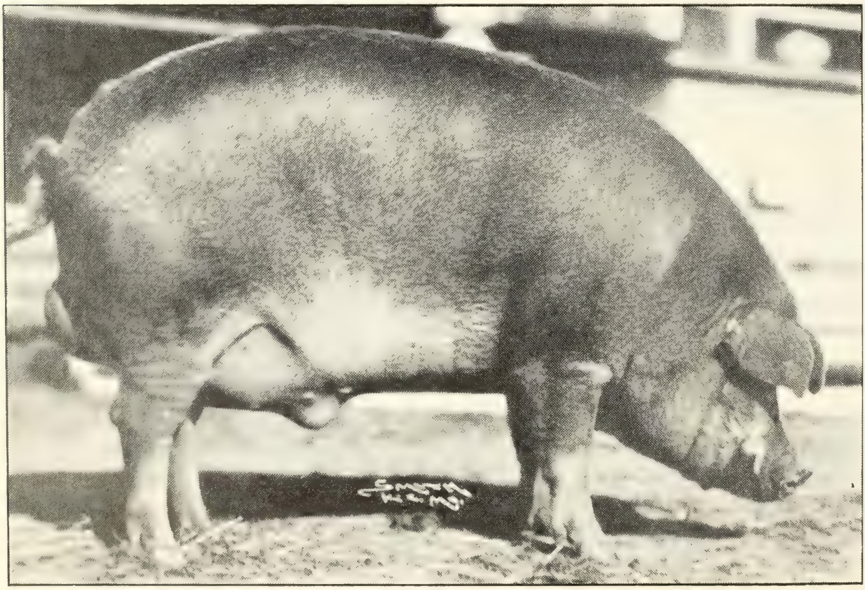


Figure 47, Duroc Boar

Poland China

The Poland China hog originated in Butler and Warren Counties, Ohio. This breed undoubtedly was derived from the crossing of several breeds. In the seventies two farmers—A. C. Moore, of Canton, Ohio, and D. M. Magie, of Oxford, Ohio, developed a widespread reputation for their hogs and advertised them extensively. Their hogs were known at that time, respectively, as the Moore hogs and the Magie hogs. From the Moore and Magie hogs was developed the breeds now known as the Poland China.

The early Poland China hog was a large, rugged, coarse-eared, heavy-bones prolific, spotted animal that attained a good market weight but was not of the easiest feeding type. During the last decade of the nineteenth century and the first decade of the twentieth century many Poland China breeders, especially those breeding for the show ring, followed what may be termed a fad in their breeding operations. The fashionable type was a short-legged, small, compact-bodied hog popularly known as the "hot blood." It has six white points, namely, four white feet and a white splash on the end of the tail and at the point of the nose. The sows were neither prolific nor very good sucklers.

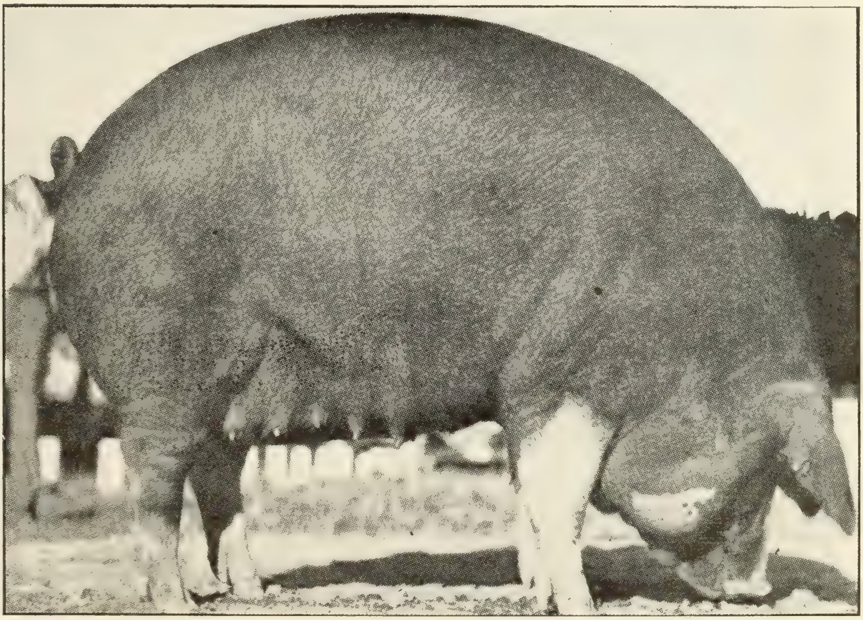


Figure 48, Poland China sow

During the last 30 years the type of Poland China hog has been changed materially. On only very few farms can one find any of the old hot-blood Poland Chinas. On a large number of farms, however, Poland Chinas of what may be termed the "medium type" are produced. Many breeds of Poland Chinas still produce the large type, but not the extremely large type, which was popular among some breeders shortly after the close of the World War.

The boars have big, heavy bone, are rugged, possess plenty of length and depth, and with it all have good quality. Mature boars of this type in show condition weigh from 850 to 1,000 pounds. Some animals show greater weights. In breeding condition aged boars should weigh from 650 pounds up and sows from 500 pounds up. The sows are prolific, good sucklers, and are capable of raising good-sized litter. They have plenty of length, are smooth, with good, full shoulders and well-rounded hams. They are naturally active, take plenty of exercise, and are capable of producing strong litters at farrowing time. The color of the present-day Poland China generally is black. Many of them have white spots on different parts of the body.

The Poland China produces an excellent finished carcass at an early age. Hogs of this breed often weigh 200 pounds at 6 months of age.

There are three associations in the United States that register purebred Poland China hogs, namely, the American Poland China Record Association, Union Stock Yards, Chicago, Illinois; the Standard Poland China Record Association, Maryville, Missouri; and the National Poland China Record Association, Winchester, Indiana.

Reference: Farmers' Bulletin 1263, "Breeds of Swine", page 4, United States Department of Agriculture, Washington, D. C.

Hampshire

The Hampshire breed originated in the English county of the same name and was introduced into the United States during the first half of the last century. When the Hampshire hog first began to be popular in the United States it was often referred to as the Thin Ring hog and was classed as a bacon breed. It is now recognized as one of the lard breeds. Hampshires have made rapid progress in popularity during the last 20 to 25 years. Sows of the breed are prolific. The mothers are good sucklers and make good use of grass in pastures.

The most striking characteristics of the Hampshire is the white belt around its body, including the shoulders and front legs. The standard of perfection for Hampshire looks with disfavor upon white showing high on the hind legs and on belts greater than one-fourth the body length. Hampshire breeders sometimes discard excellent animals in their breeding operations because of imperfect belts or because they have white hind feet or legs.

The Hampshire in general appearance is smooth and has legs with medium-sized bones. Hampshire breeders are making efforts to increase the size of the bone and the strength of the feet and legs. The body is often not so broad as that

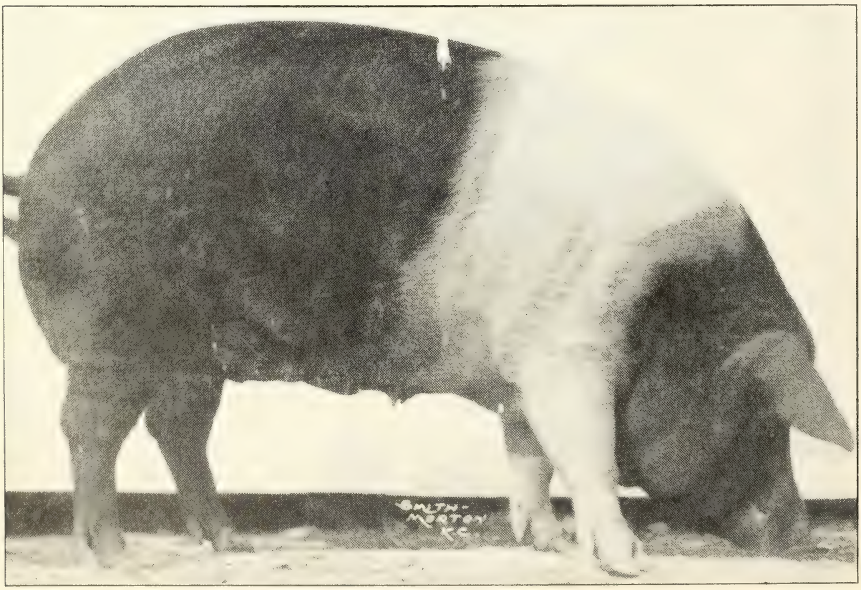


Figure 49, Hampshire Sow

of typical hogs of the other lard breeds, but it is deep and smooth and produces desirable sides for bacon. The jowls are light, the head is small and narrow, the snout rather straight and of medium length, the ears erect, the shoulders smooth and well set, and the hams deep but usually not especially thick. The flesh is of good quality. Animals of this breed sell readily on the open market.

The Hampshire possesses good growing and fattening qualities, and pigs may be brought to marketable weight at from 6 months old up. In show condition mature boars of the breed weigh from 600 to 850 pounds, some attaining a greater weight. Mature sows in show condition weigh from 500 to 700 pounds.

The record association for this breed is the Hampshire Swine Record Association, 915-917 Commercial Bank Building, Peoria, Illinois.

Reference: Farmers' Bulletin 1263, "Breeds of Swine", pages 9 and 10, United States Department of Agriculture, Washington, D. C.

Chester White

The Chester White breed had its origin in Chester County, Pennsylvania. The large, coarse hogs found in the Eastern States, especially in Pennsylvania, early in the nineteenth century, were a mixture of the Yorkshire, Lincolnshire, and Chesshire hogs, all of which were of English origin. In Pennsylvania these hogs were crossed on smaller type hogs, but the most successful cross was by using an imported hog from Bedfordshire, England. This crossing was continuously improved up to 1848, when the breed reached such a degree of purity that it could be relied on to reproduce its desirable qualities. It was named "Chester County White", in 1848, but the word "County" was soon dropped and the present name became established.

The first record association for the breed was formed in 1884, and to it records all individuals of the breed trace. Later there were eight different record associations catering to the business of the breed, and as these lessened the unity of action among the breed's advocates the popularity that the breed had acquired during the latter half of the nineteenth century seemed to wane but in recent years it has regained its popularity.

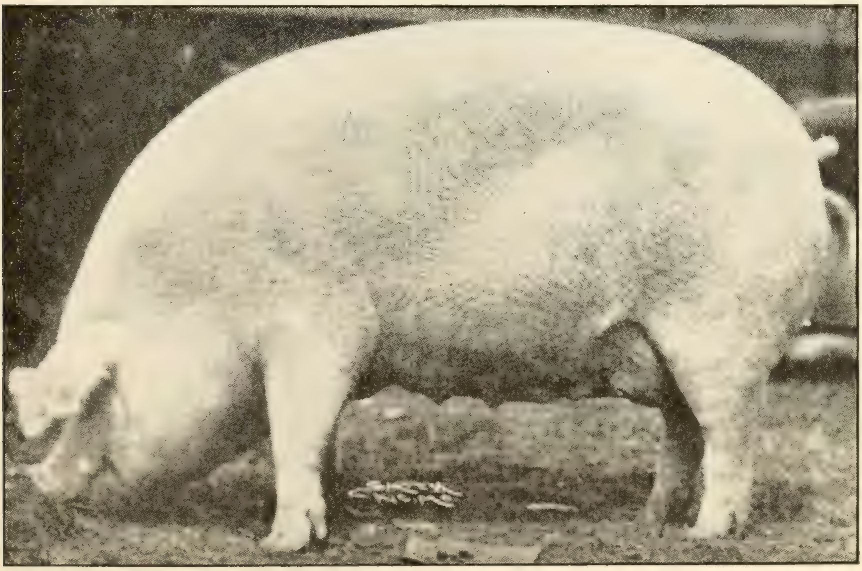


Figure 50, Chester White Sow

The Chester White is a very prolific hog. It has a good disposition and easily adapts itself to its environment. It matures early, and, being a good grazer, a good feeder, and possessing good dressing qualities, has demonstrated its utility on many farms. From 1884 the uniformity of size for age of the Chester White has been commendable. The score-card type or the standard of excellence is very similar to the type of the other lard breeds of swine. Mature boars of this breed weigh from 600 to 900 pounds, some individuals showing a weight of 1,000 pounds. The sows weigh from 500 to 700 pounds.

The record associations for the breed are Chester White Swine Record Association, Rochester, Indiana; the O. I. C. Swine Breeders' Association, Goshen, Indiana; and the Breeders Chester White Record Association, 603 Third Street, Des Moines, Iowa.

Reference: Farmers' Bulletin 1263, "Breeds of Swine", pages 6 and 7, United States Department of Agriculture, Washington, D. C.

Berkshire

The Berkshire is one of the oldest of the improved breeds of swine. It was originated and developed in England and is still raised extensively in that country. Many animals of this breed have been imported into the United States and Canada from English herds. Mention is made of the Berkshire hogs in England and Scotland as early as 1789, large specimens being compared with those of other breeds.

Berkshire hogs are found in noted herds in the United States. They are of medium size, generally smooth and of good length and depth, having legs of medium length with fair size. In color this breed is similar to the Poland China, but has not so many white spots. The peculiarity of the Berkshire breed is the short, upturned nose. The face is usually dished and the ears are erect but inclined slightly forward. Berkshire hogs have good width of body, the back is broad and the ribs well sprung. The hams and shoulders are generally smooth and well fleshed. The meat of the Berkshire is generally smooth and well fleshed. The meat of the Berkshire is generally regarded as good in quality.

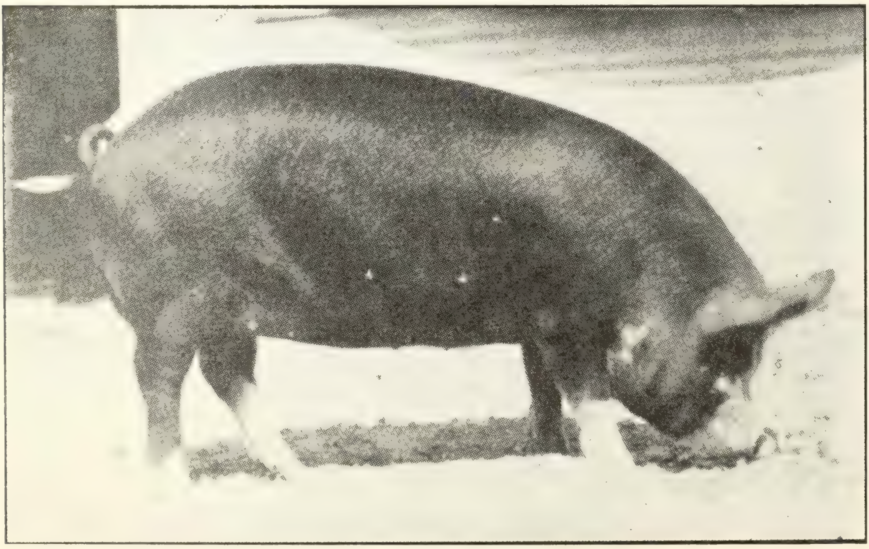


Figure 51, Berkshire Sow

Good Berkshire pigs can be fed to market weight at from 6 months of age up. Mature boars of this breed in good show condition usually weigh from 600 to 850 pounds. Some attain a heavier weight. Mature sows should weigh from 450 to 650 pounds.

The record association for this breed is the American Berkshire Association, 508½ East Monroe Street, Springfield, Illinois.

Reference: Farmers' Bulletin 1263, "Breeds of Swine", pages 7 and 8, United States Department of Agriculture, Washington, D. C.

JUDGING SHEEP

The judging of sheep differs from that of other animals in that the hand must be used almost exclusively to determine the details of form and condition. Before the sheep is handled view it from the front to study the make-up of the head, the width of brisket and the length, straightness and placing of the front legs. From the side study the size, lines, low setness, length and style. From the rear note the width and evenness of body, development of hindquarters and set of legs.

Knowing the location of the parts of sheep is very important in judging.

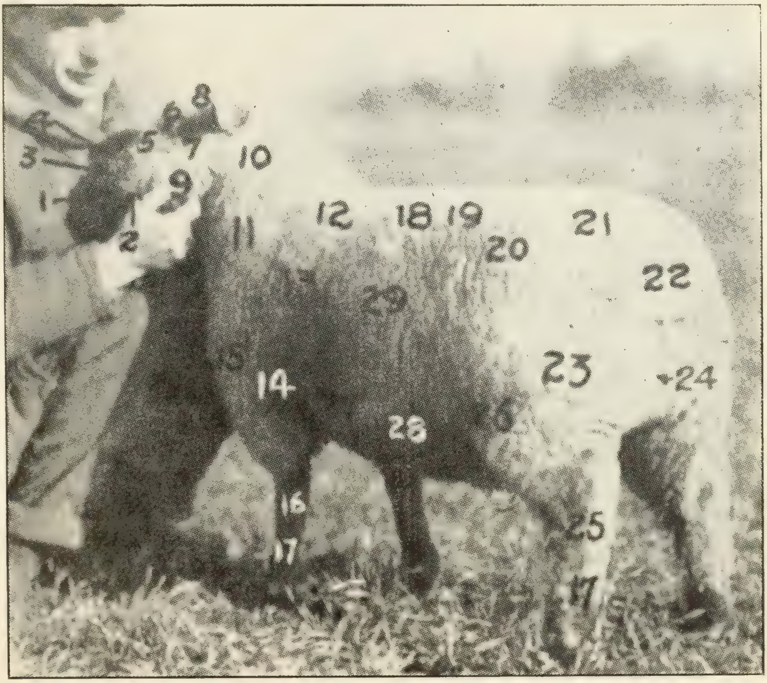


Figure 52, Points of Sheep

1. Mouth
2. Lips
3. Nostrils
4. Nose
5. Face
6. Forehead
7. Eye
8. Ear
9. Jaw
10. Neck
11. Shoulder vein
12. Top of shoulder
13. Shoulder
14. Arm
15. Brisket
16. Knee
17. Shank
18. Back
19. Loin
20. Hip
21. Rump
22. Dock
23. Leg of mutton
24. Twist
25. Hock
26. Hind flank
27. Front flank
28. Belly
29. Ribs

Placing Card for Breeding Sheep

Contestant's Number____________ Class______________________________

PLACING ON COMPARATIVE POINTS	First	Second	Third	Fourth	Grade
1. General appearance: Size, form symmetry, breed, and sex characteristics					
2. Forequarters: Head, neck, shoulders, ribs, chest, fore legs					
3. Hind quarters: Back, loin, rump, dock, twist, thighs, hind legs					
4. Quality and condition: Refinement of features, bone and hair; color, pliability of skin; firmness, evenness of flesh					
5. Fleece: Density, length, color, crimp, yolk, foreign material					
				TOTAL	
(A) Average of the above grades					

FINAL PLACING	First	Second	Third	Fourth	Grade
(B) Final Placing Order					

FINAL GRADE: A+B÷2=

Handling

The proper way to handle a sheep is to keep the fingers together and lay them flat on the animal, except when it is necessary to grasp the parts, as in feeling the leg of mutton. The sheep should not be pounded around nor should the fingers be stuck into the wool. The sheep may be handled, beginning either at the front or the rear. Figures 53, 54, 55, 56, 57, 58, 59 and 60, show the proper methods of going over the different parts.

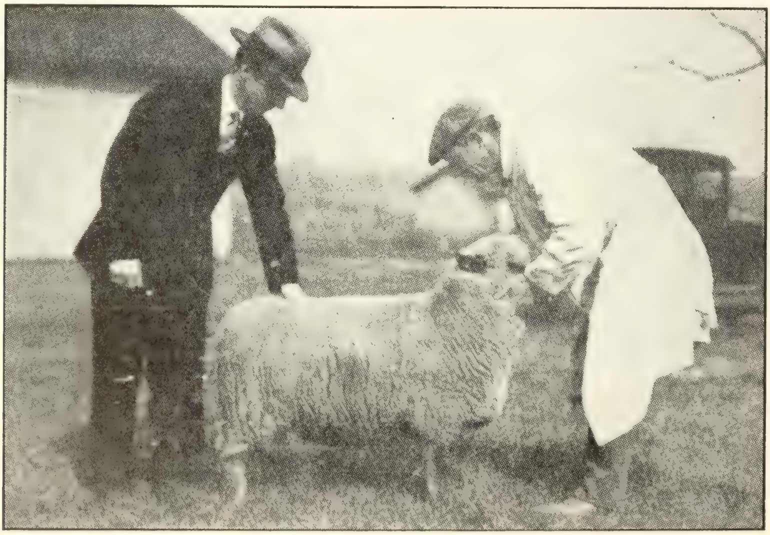


Figure 53, The loin should be thick, with no prominence of the backbone

Age

Age may be estimated by the teeth. Sheep have eight permanent front teeth (nippers or incisors) in the lower jaw, but none in the upper. Permanent teeth are those which replace the baby or milk-teeth. The milk-teeth are narrow and white while the permanent teeth are larger and broader, widening out toward the top. The permanent teeth take the place of the temporary in regular order by pairs as the sheep grows older. The first pair, of middle teeth, replace the corresponding pair of milk-teeth when the sheep is about one-year old. The next pair (one on each side of the central pair) appear at two years, the third pair at three years, and the fourth pair at four years. At eight or nine years the teeth begin to fall out, and the sheep is called "broken mouthed." To observe the teeth, hold the sheep with one hand under the jaw and press down the lower lip with the thumb and forefinger.

Weight

The most desirable fat lamb weighs about 80 pounds. Cuts from a lamb of this size are most popular with the consumer. About 90 percent of all sheep marketed are lambs. Show lambs usually weigh more than market lambs because they are older and fatter. Yearling wethers for slaughter weigh about 100 pounds. Yearling show wethers weigh 125 to 200 pounds, depending on the breed.

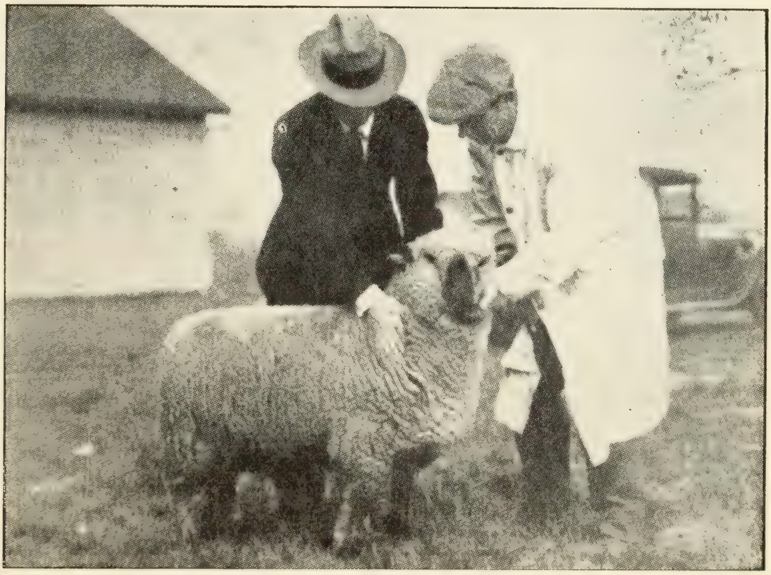


Figure 54, The neck should be thick and full at the junction with the shoulders

Body Conformation

The mutton sheep should be low set, blocky, compact, smooth and symmetrical in build. A short, broad, squarely built head, wide between the eyes and ears, usually indicates a thick, blocky body form. The neck should be short, blending smoothly into the head and into the shoulders. The shoulders should be compact, closely knit on top, and well covered with flesh. The heart girth should be full, the back strong and wide with a full, wide, deep spring of rib, thus giving a capacious chest and middle. The loin should be wide and thick. The rump should be long, wide and level, letting down into a deep, plump, full leg of mutton. The legs should be straight and strong.

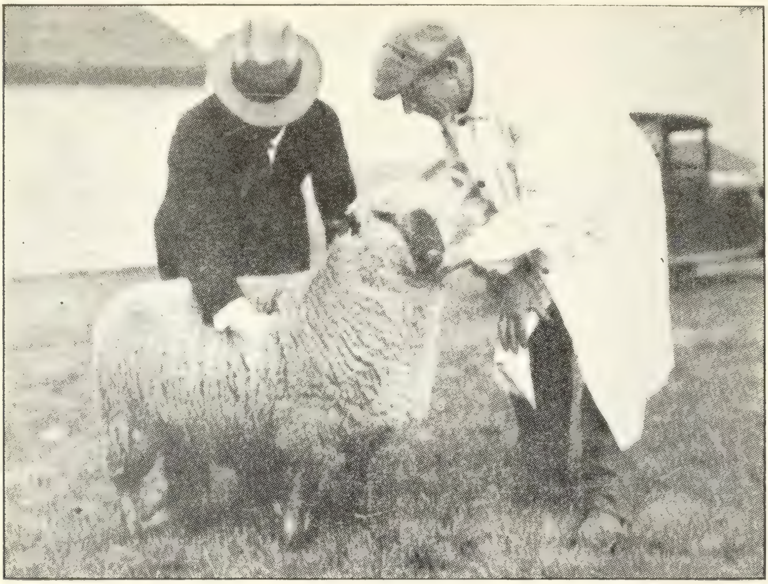


Figure 55, A full heart girth and a thick chest gives fullness and smoothness of form

Condition

Condition is thickness of fleshing. It is indicated by the thickness of the dock and thickness of fleshing over the back, loin, ribs and shoulders. To determine the thickness of fleshing the sheep must be felt or "handled" with the hands. In the ideal fat sheep the flesh is firm and the back is well covered with flesh. The flesh should extend well down over the sides without softness.

There are five reasons why the butcher demands fat animals: (1) Other things being equal, the fat animal will dress a higher proportion of edible meat

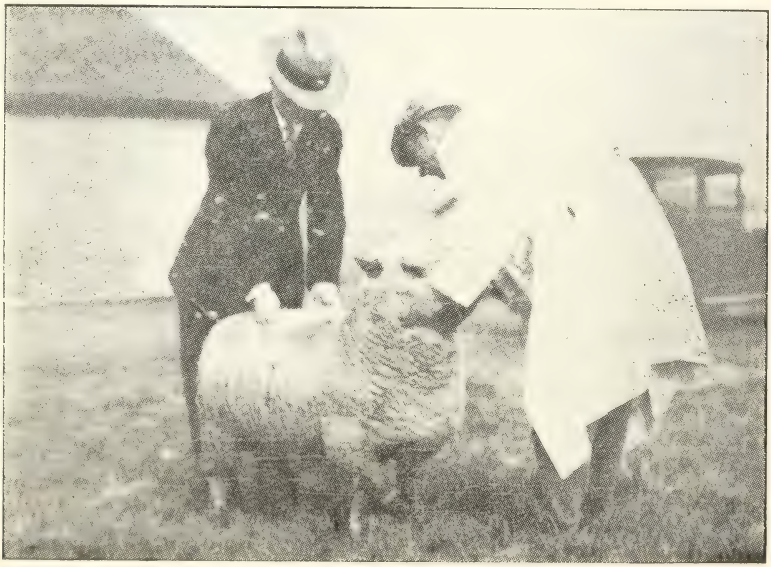


Figure 56, The loin should be wide and thick to offal than will a half fat animal; (2) fat adds to the appearance of the meat; (3) fat carcasses lose less in weight when cooling out in the refrigerator and in cooking; (4) the keeping qualities of the fat carcass excell those of the thin carcass; (5) a considerable amount of fat distributed through the lean makes the meat more tender, more juicy, and of a better flavor.

Quality

Quality is indicated by a neat, well-turned head and ear; by fine, dense bone of medium size; by soft, silky hair on the face and legs and by mellow skin and a smooth, even covering of flesh. Quality is important because the sheep possessing quality usually grows and fattens on less feed and will dress out with less waste than will a coarse sheep. The pelt, which is the skin with the wool on, should be light. The quality of the flesh should be determined when the sheep is examined for condition.

Wool

Quality of wool is determined by its length, density and evenness of covering over the body. A fleece of high quality should be fine, pure and soft, with a close, regular crimp, and should be of uniform diameter of fiber all over. The shortest fleeces usually show the most quality. By crimp is meant the wave in the fiber.

A fleece in good condition is clean and free from harshness and foreign matter, such as dirt, burrs and chaff. Too much yolk or grease is not desirable, but enough should be present to give the fleece a soft texture and a bright luster.

Undesirable Features

(a) Too great weight is associated with coarseness. The cuts are too large for the retail trade. (b) A flat-ribbed, narrow-chested, drooping rumped, upstanding individual with peaked hindquarters carried a large amount of waste in proportion to the valuable cuts. Openness at the top of the shoulder, roughness and angularity invariably go with bareness of shoulder, back and loin, a thin leg of mutton and an excess of bone. Narrow shoulders and long, crooked legs indicate low vitality and poor fleshing qualities. (c) A long narrow head with a pinched muzzle indicates weakness of constitution. A thin neck and narrow head

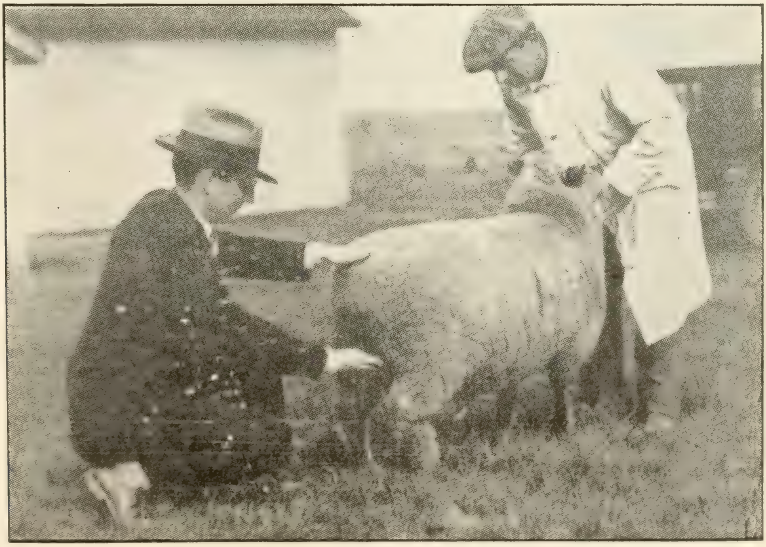


Figure 57, A deep twist is desirable

go with a slender body. (d) Weak, short, thin loins are found in angular, upstanding individuals, lacking depth of flesh. (e) A drooping rump, thin-fleshed legs and a high, undeveloped twist greatly reduce the value of the carcass. The hind legs and rump of a lamb represent 40 percent of the value of the carcass to the butcher. (f) Coarseness; a thick, wrinkly skin covered with coarse wool; a large open frame with heavy bone and rough joints, and an uneven distribution of flesh add to the waste and detract from the value of the animal.

Comparative Judging

This is the placing or rating of two or more animals according to merit. It is a matter of comparison. Each animal must be inspected, separately, each of the main points of every animal compared and balanced separately and collectively, until the animal is selected which most nearly fulfills all the requirements of the class. This animal is the first prize winner, the next best is the second prize winner, and so on.

Breeding Sheep

The animal used for breeding must have all the excellence of size, form, quality and condition of the fat sheep and must be strong in constitution, conform to the breed type and show pronounced sex characteristics. The fleece is of more importance in breeding sheep than in fat sheep.

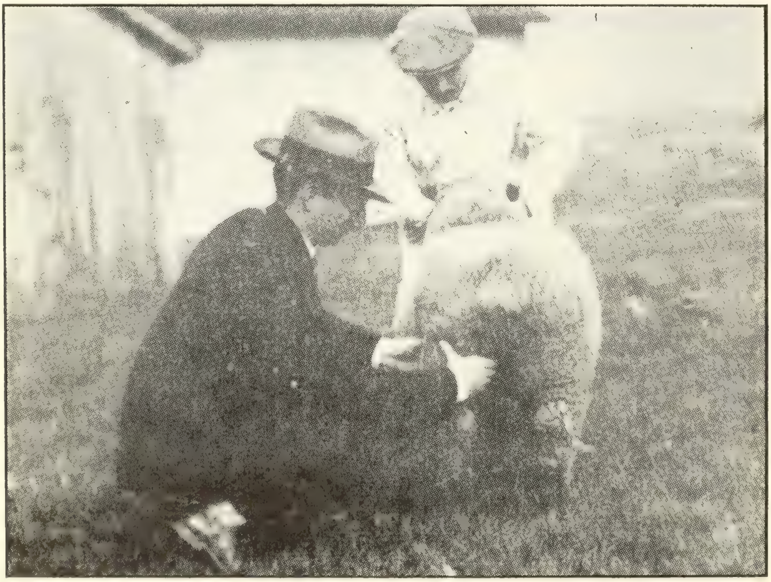


Figure 58. The size of the leg of mutton is determined by grasping it well up with both hands

Constitution

A sheep with a strong constitution has the general appearance of being very vigorous and thrifty. A large nostril, strong muzzle, full chest, wide spring of rib, wide chest floor, and a capacious body are indicators of a strong constitution.

Breed Type

The points usually considered under breed type are color, size, fleece and skin. For example, a Shropshire with a speckled face of a Hampshire that is small like a Southdown is said to be "off type." Breed types is one of the first

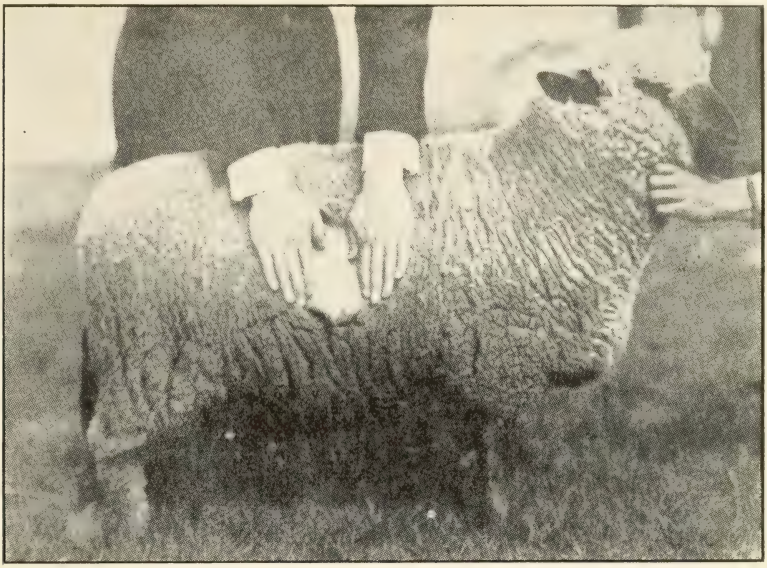


Figure 59, The fleece is examined by parting it on the shoulder, on the side and on the thigh

things to be considered in judging purebred breeding sheep. A sheep that has an excellent body form but is lacking in breed type cannot be placed first in its class.

The Ewe should be:

(a) Well-grown and rugged; (b) feminine; (c) straight in body lines and showing capacity for feed; (d) sound in mouth and udder; (e) covered with a dense, heavy fleece; (f) from one to four years old; (g) similar to the other ewes in size and breeding; (h) a good milk producer.

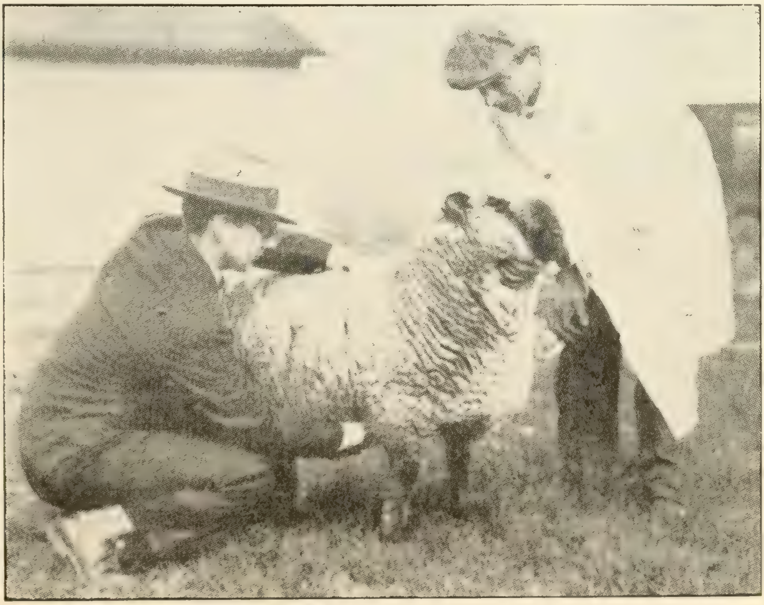


Figure 60, A deep, wide chest indicates a strong constitution

The Ram should be:

(a) Strong, active, vigorous and massive, with bold features; (b) from one to three years old; (c) a purebred of pronounced breed and type characteristics; (d) symmetrical and evenly developed; (e) covered with firm flesh, and a dense fleece; (f) strong and straight in his legs.

Breeds of Sheep

The more common breeds of sheep may be classified according to type as follows:

Sheep	Mutton	Medium Wool	Southdown, Shropshire, Hampshire, Oxford, Cheviot, Dorset, Suffolk, Tunis, Corriedale, Ryeland, Columbia
		Long Wool	Lincoln Leicester Cotswold Romney
	Wool	Fine Wool	American and Delaine Merino, Rambouillet

Two General Types

The classification divides the breeds of sheep into two general types, according to the purposes for which they are bred. The mutton type is bred primarily for mutton, while the fleece is given only secondary consideration; the wool type is bred primarily for wool, with mutton as a secondary consideration. Consequently, there is a wide difference in the make-up of the two types. The mutton type is square, blocky, and meaty in build, while the wool type is more angular.

In presenting information on judging sheep the Southdown, Shropshire, and Hampshire are the more important breeds, with some interest being manifest in the Corriedale for Mississippi. This being true, only these breeds are discussed.

Southdown

Origin—The Southdown is one of the oldest of the improved breeds of sheep. Native sheep of Sussex County, England, were bred up and developed by the process of selection.

Color—The hair on the face and legs is mouse brown.

Size—Rams, 200 pounds, Ewes, 145 pounds.

Fleece—Length 2 inches. Weight 5 to 8 pounds.

Strong Points—The Southdown is the most ideal in form of the breeds of sheep. It ranks among the first in quality of mutton. It is an excellent fattener, a fair grazer and only fairly prolific. For crossing and grading the rams are extremely propotent.

Criticisms—The Southdown has been criticized for its small size and light fleece. Horns or evidence of their presence, a dark poll, blue skin and speckled face, ears and legs are disqualifications.

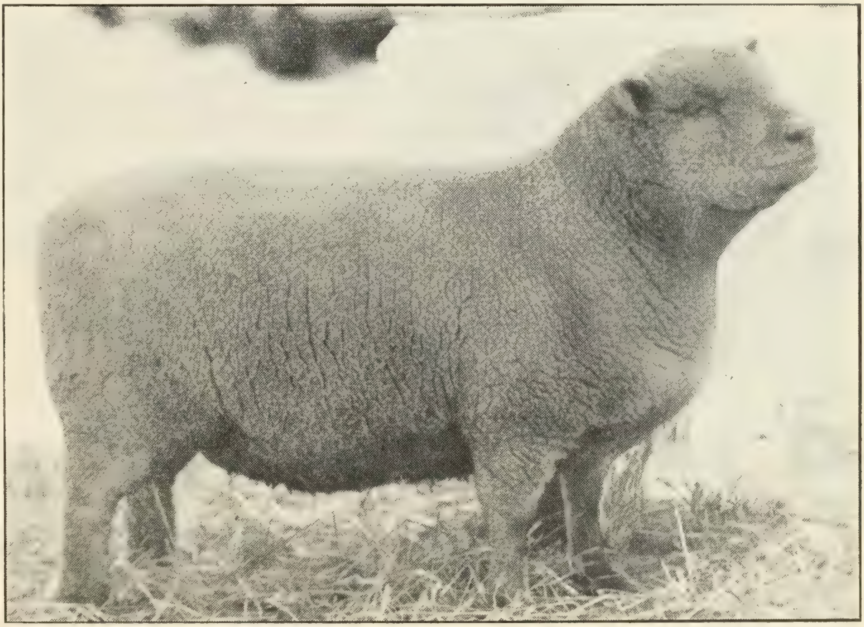


Figure 61, Southdown ewe

Shropshire

Origin—Shropshire and Staffordshire, in central western England. Native sheep of these two counties were improved by the use of Southdown, Leicester and Cotswold rams.

Color—The hair on the face and legs is black.

Size—Rams, 225 pounds, ewes 160 pounds.

Fleece—Length 2½ to 3 inches. Weight 8 to 10 pounds.

Strong Points—The Shropshire has been called the "rent-paying sheep" because it combines an excellent mutton form with a heavy fleece of good quality. It is very prolific, is a good fattener, and a fair grazing sheep. It is well adapted to corn-belt conditions.

Criticisms—Dark wool on the head and face are objectionable. Black fibers in the fleece, blue spots on the skin, a rusty brown or faded brown color of face, spotted face, and horns or evidence of their presence, are disqualifications.

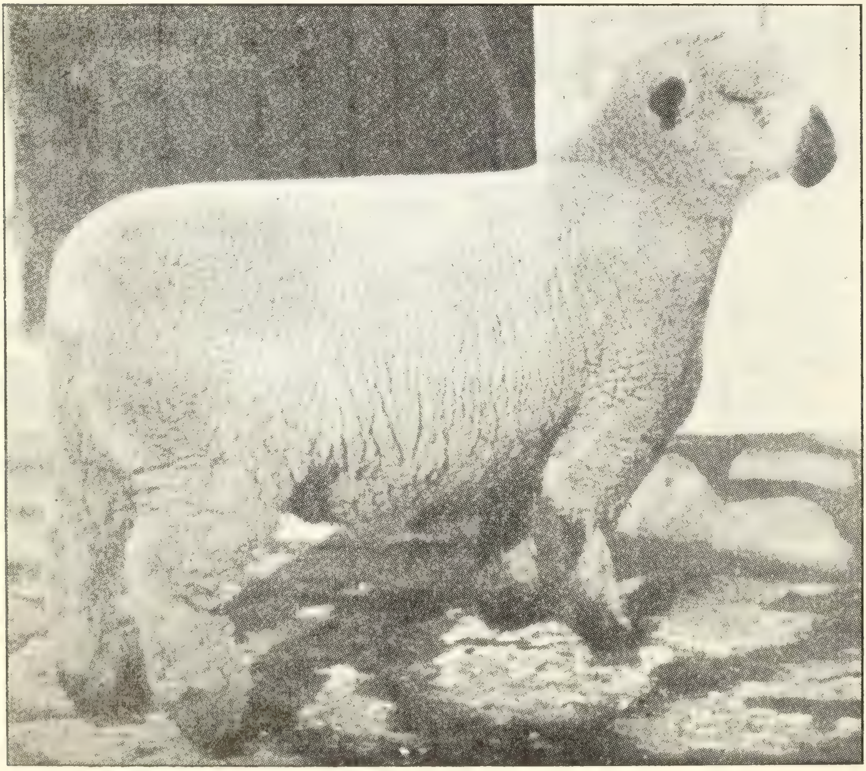


Figure 62, Shropshire

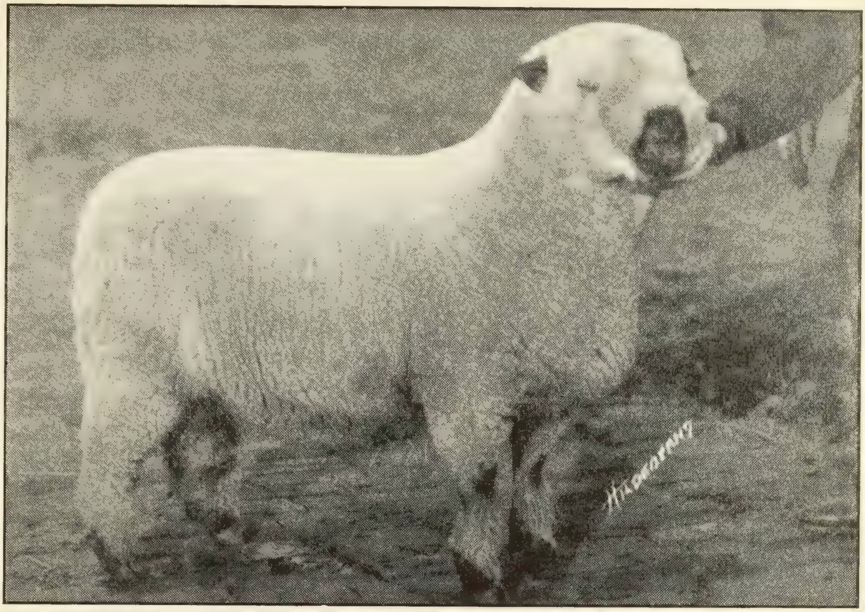


Figure 63, Hampshire

Hampshire

Origin—Native sheep of Wiltshire and Hampshire, England, were improved by the use of Southdown rams.

Color—The hair on the face and legs is black.

Size—Rams, 275 pounds. Ewes, 200 pounds.

Fleece—Length, 2½ inches. Weight 8 pounds.

Strong Points—The Hampshire is noted for its large size and early maturity. It thrives exceedingly well on forage crops. Lambs eight and nine months old can be made to weigh 200 pounds. The mutton is the finest quality of any of the larger breeds. Hampshire ewes are very prolific.

Criticisms—Hampshire are inclined to fall off behind the shoulders. Dark fibers in the fleece and a dark tinge to the head wool are quite common and are very objectionable. A bar of light brown or gray hair across the face just below the wool cap, is unfavorably regarded in rams. Horns or evidence of their presence amount to a disqualification.

Corriedale

The Corriedale is a new breed which has developed in New Zealand since 1880. Lincoln, Leicester and Romney rams were bred to Merino ewes, and after close culling toward the type desired the half-breeds were mated together. This resulted in a breed called the Corriedale.

The Corriedale is a combined wool and mutton sheep. The face, ears and legs are white. The fleeces average 10 to 12 pounds in weight and 3 inches or more in length.

Reference—University of Kentucky, College of Agriculture, Extension Division Circular 96, "Fundamentals of Livestock Judging, A Study of Types of Breeds", pages 68 to 78, June 1935, Lexington, Kentucky.

PART III

DAIRY CATTLE JUDGING AND SELECTION

The subject of dairy cattle judging constitutes one of the major divisions of successful dairy farming and is closely related to the other divisions, feeding and breeding. The real students of dairy judging must be practical and keen sighted to attain success, and must have clearly in mind the ideal dairy type animal necessary for high milk production. Not until the students have mastered all these details of dairy form, as well as the different breed characteristics, can he expect to be classed as a dependable judge of dairy cattle.

Classes of Dairy Cattle

Junior Bull Calf	4 months and under 1 year
Senior Bull Calf	1 year and under 18 months
Junior Bull	18 months and under 2 years
Bull	2 years and under 3
Bull	3 years and under 4
Bull	4 years or over
Cow	5 years or over
Cow	4 years and under 5
Cow	3 years and under 4
Senior Heifer	2 years and under 3
Junior Heifer	18 months and under 2 years, not in milk (Heifers calving after 24 months actual age may enter as 2-year-olds)
Senior Heifer Calf	Heifer not in milk, 1 year and under 18 months
Junior Heifer Calf	4 months and under 1 year

Dairy Type

A proficient judge of dairy cattle must thoroughly understand what is meant by dairy type and also have a clear knowledge of the relative values of the different parts of the animal, as set forth on the score card for each breed.

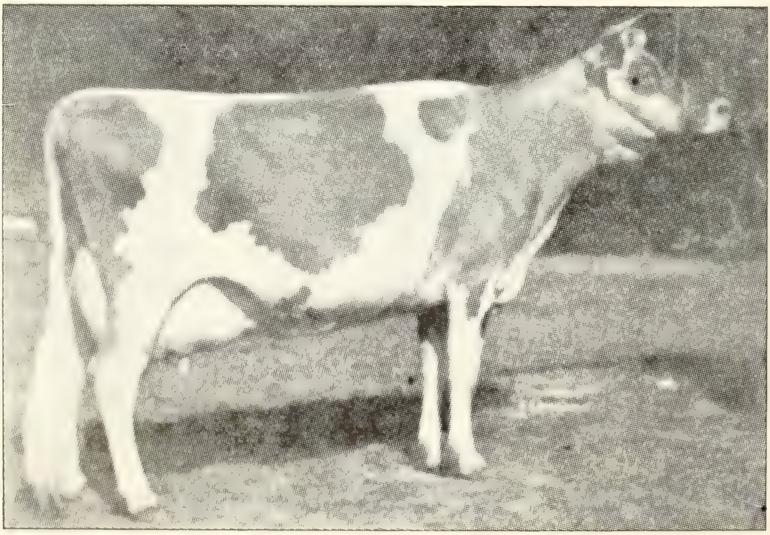


Figure 64, Desirable type

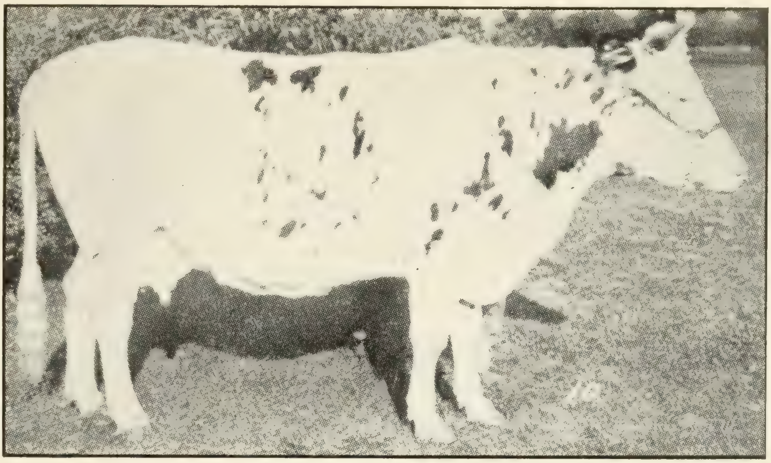


Figure 65, Undesirable type

To produce large quantities of milk the cow should have a large digestive system; a strong constitution; a highly developed mammary system; and be outstanding in dairy temperament. These essentials of body form together with proper breed characteristics, size, quality, and general appearance make up what is known as dairy type.

Figures 64 and 65 illustrate desirable and undesirable dairy type.

To judge dairy cattle successfully it is very essential that the judge know the different parts of the cow and their location on the animal together with the breed characteristics of the different breeds. Below is a diagram showing the different parts of the cow and their location. This diagram is followed by the score card used in judging dairy cattle.

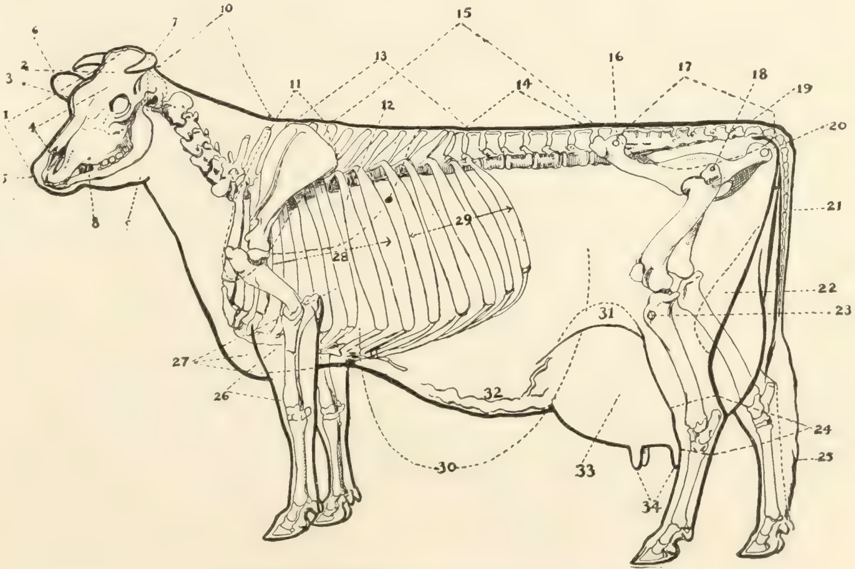


Figure 66, Diagram showing parts of the cow

1. Head
2. Forehead
3. Eye
4. Face
5. Muzzle
6. Ear
7. Horn
8. Jaw
9. Throat
10. Neck
11. Shoulder
12. Crops
13. Chine
14. Loin
15. Back
16. Hip or hipbone
17. Rump
18. Thurl
19. Tail head
20. Pin bone
21. Tail
22. Thigh
23. Stifle point
24. Hock
25. Switch
26. Forearm
27. Chest
28. Fore ribs
29. Back ribs
30. Barrel
31. Flank
32. Mammary veins
33. Udder
34. Teats

Placing Card for Dairy Cattle

Contestant's Number__________ Class____________________

PLACING ON COMPARATIVE POINTS	First	Second	Third	Fourth	Grade
1. Body capacity and size: Depth, width and length of body; full size for breed					
2. Dairy temperament: Tenderness to leanness, angularity; absence of beefiness at neck; withers, brisket, back and thigh					
3. Mammary system: Size, shape, attachment and soundness of udder; size and placement of teats					
4. Health and vigor; Absence of indications of frailty; delicacy, weakness of constitution, sickness and lack of fertility					
				TOTAL	

(A) Average of the above grades

FINAL PLACING	First	Second	Third	Fourth	Grade
(B) Final Placing Order					

FINAL GRADE: A+B÷2=

Body Capacity

Body capacity is indicated by a large barrel. If a cow is to be able to consume large quantities of roughage and grain, she must have room to store it. To be able to do this the barrel must be long, deep and wide. Length of barrel is determined by the distance from the shoulders to the hips. This distance should be great and the ribs should be broad, flat and spaced well apart. Ordinarily, one should be able to insert three fingers between the last two rear ribs. Depth of barrel is measured from the top of the back to the bottom of the stomach. It is very essential that dairy cows be deep through the barrel and never shallow in this region. The width of the barrel is determined by the spring of the ribs. The ribs should be well sprung on both the top and sides of the barrel. Such a large barrel must be held up by a wide and strongly muscled loin and back. The back of a dairy cow from withers to hips should always be straight.

The flanks should be deep and full; fullness of flanks indicates high development of the digestive system. The cow with a shallow drawn flank is usually a light feeder.

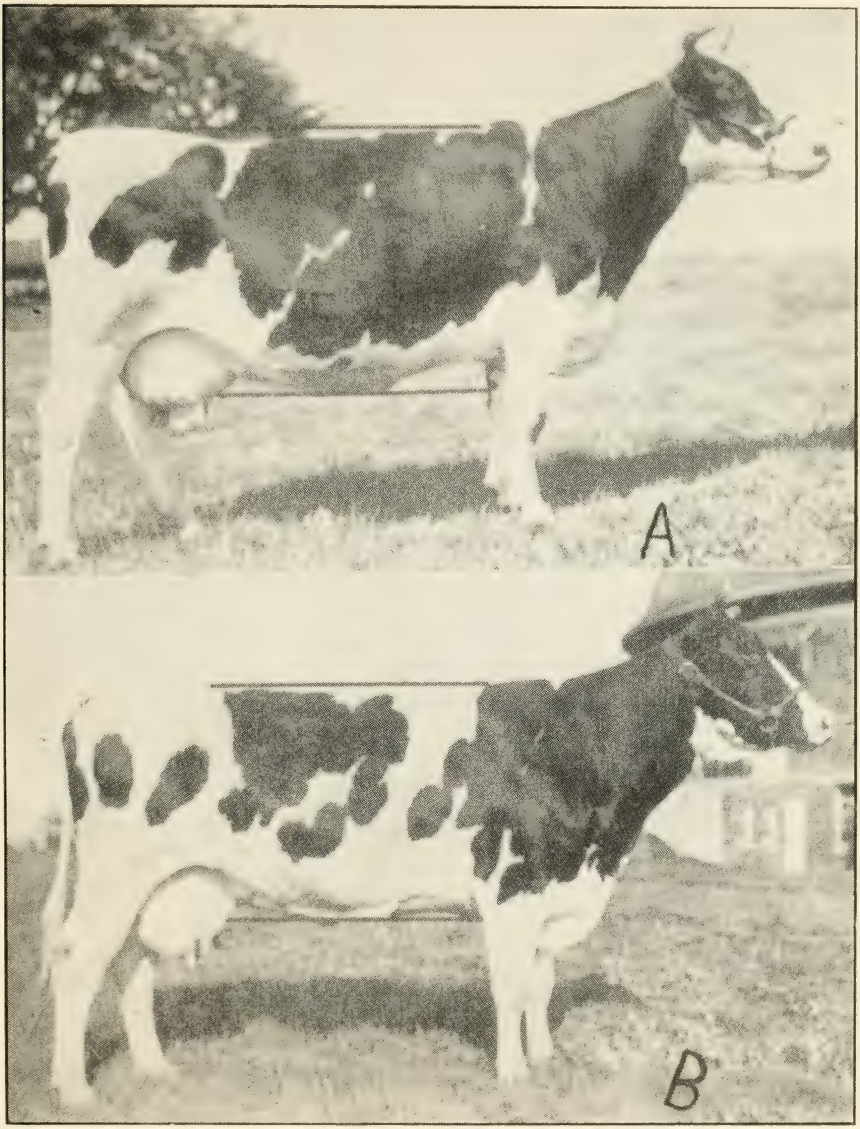


Figure 67, A contrast in body capacity

Since there is a direct relation between feeding capacity and milk yield, it is essential that dairy cows have large feeding capacity. The cow in figure 67-A (above) has excellent capacity, as shown by great depth, length and width of barrel. The lower cow in Figure 67-B lacks depth and width of body.

Dairy Temperament

Dairy temperament is absolutely essential in a dairy cow; but is a term which confuses many students. The dairy animal must not only have the essentials of body form already discussed, but also must possess the tendency or ability to utilize the body mechanism to produce large quantities of milk. This tendency to produce milk is called dairy temperament and is indicated in many ways as follows:

(1) Forehead: Broad between the eyes; dishing. The wide forehead is associated with strong constitution. Too great width at poll is associated with coarseness. Dish of forehead indicates breeding, quality, and dairy temperament.

(2) Face: Of medium length; clean cut; feminine; the bridge of the nose straight. The face may be too short, or it may be too long. The short blocky face indicates tendency to beefiness and is associated with too short bodied animals Extreme length or narrowness indicates generally too rangy build, weak constitution and slow developing qualities. The face should be distinctively feminine.

(3) Muzzle: Broad with strong lips; nostrils large and open; jaws strong. Good feeding tendency and constitution are indicated by a broad muzzle and large open nostrils. The lines from face into muzzle should be flaring.

(4) Ears: Of medium size; of fine texture; well carried. The thin ear carried alert indicates quality. The lop or careless carried ear indicates a lack of vitality.

(5) Eyes: Large; full, mild, bright. Bright, full eyes indicate health and vigor. The setting should be prominent but not too bulging.

(6) Horns: Small, tapering finely toward the tips, set moderately narrow at base, inclining forward; well curved inward, not to be discounted if neatly dehorned. The beauty of the head and general appearance of quality can be made or marred by the size and shape of the horn. A firm, clean, healthy appearing horn usually denotes the same characteristics of the bones.

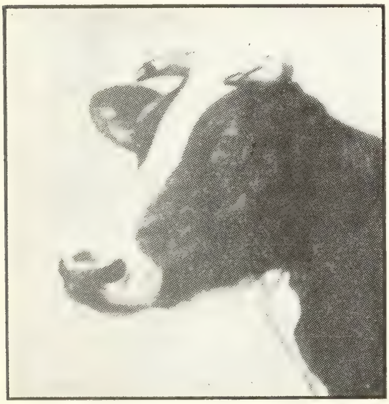


Figure 68, The true type head

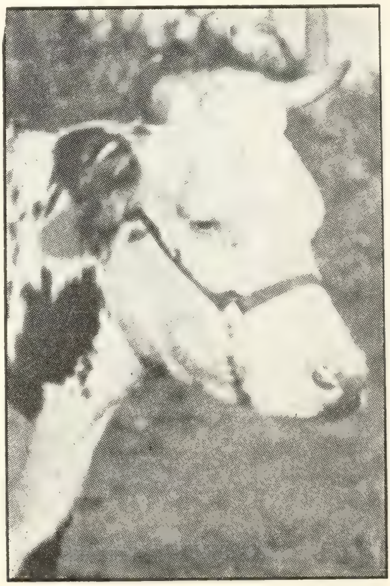


Figure 69, A Coarse head

(7) Neck: Long, fine and clean at junction with the head, evenly and smoothly joined to shoulders. Length of neck is associated with length of body. The short neck accompanies a tendency to beefiness.

(8) Shoulder. Slightly lower than the hips; moderately broad and full at sides running to a wedge at the top blending smoothly into the neck and the middle. The coarse, flat topped shoulder is associated with lack of milking qualities. Preceding first lactation period, heifers in good condition appear heavy over shoulder, reducing to proper width after freshening. Too fine shoulder indicates lack of ruggedness.

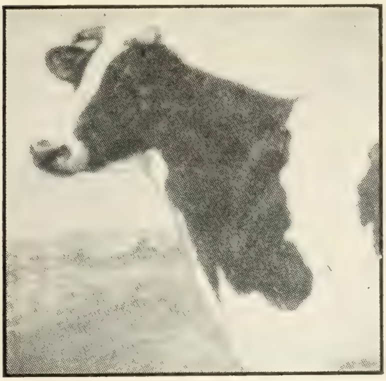


Figure 70, The true type neck and shoulders

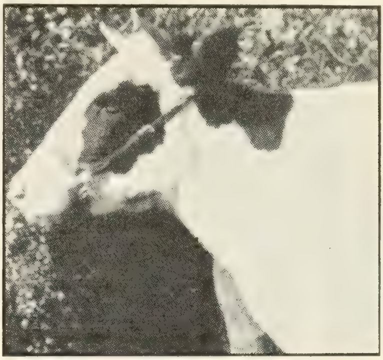


Figure 71, An example of undesirable neck

(9) Crops: Full, level with the shoulders. Fullness of crops accompanies good spring of rib and well held up body. Depression back of shoulder is associated with a weak back and lack of constitution.

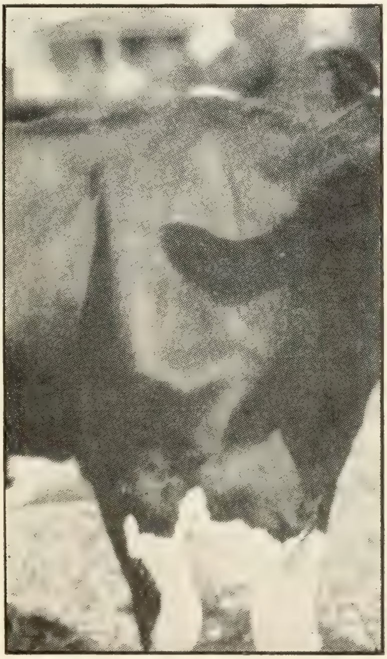


Figure 72, Weak in the crops, a poor shoulder

(10) Chine: Straight, strong, broadly developed, with open vertebrae. Widely spaced and prominent spinal processes indicate dairy temperament.

(11) Dairy temperament is indicated by a natural leaness throughout the body of the well fed dairy cow.

Therefore the dairy cow should show throughout the body a freedom from patches of fat or fat forming tendencies, and these, together with a highly developed mammary system in the dairy cow indicate dairy temperament.

Mammary Development

Mammary development includes the udder, teats, and milk veins and is a most vital factor in selecting a dairy cow. To secrete large amounts of milk, the cow should have a large udder, but above all the udder must possess softness or quality. There are two kinds of tissue found in the udder. One is a rather hard fibrous tissue, the only purpose of which is to give shape to the udder. The other is the soft tissue which contains the all important milk secreting cells. Consequently, a good dairy cow's udder should contain as little as possible of the hard tissue and as much as possible of the soft milk secreting tissue. Thus the udder should be soft, elastic, pliable and free from hard lumps. The udder should be capacious, strongly attached to the body, and should extend well up behind and far forward. The quarters should be even in size, smoothly joined at sides and only slightly grooved between the right and left half. The udder should be deep but never pendulous. The floor of the udder should be level and not cut up between teats.

Teats: Well formed; plumb, of convenient size, properly placed. Rear and fore teats should be attached on the same level in proper place and even distance apart on each side of the udder. They should hang plumb and be of convenient size for milking.

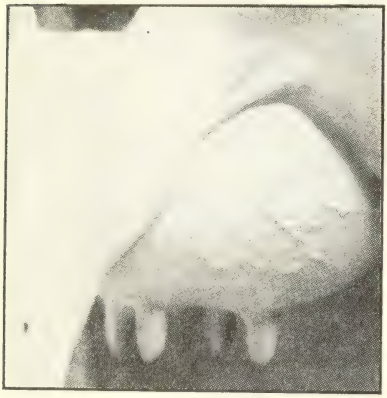


Figure 73, True type udder and teats

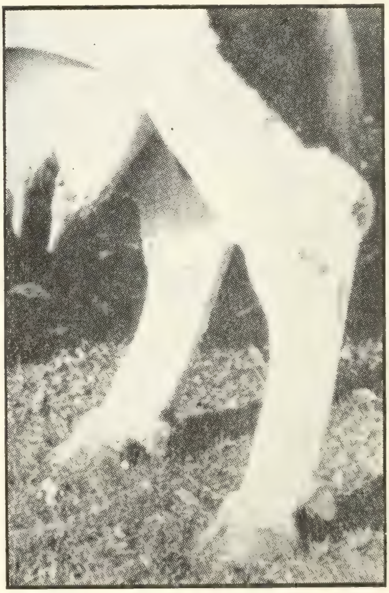


Figure 75, Teats too close, legs not straight. An example of sickle hock.

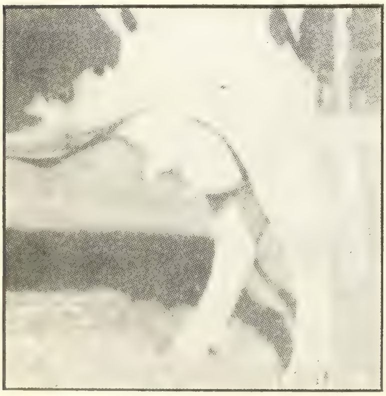


Figure 74, Teats poorly placed, small. Poor udder

Thighs: Wide, deep, straight behind, wide and moderately full in the outsides; twist well cut out and filled with development of udder; with escutcheon well defined. To afford strength the muscular development on the thigh should be full and deep on the outer surface. The twist or inner thigh should be well cut out, affording room for a wide udder attachment.

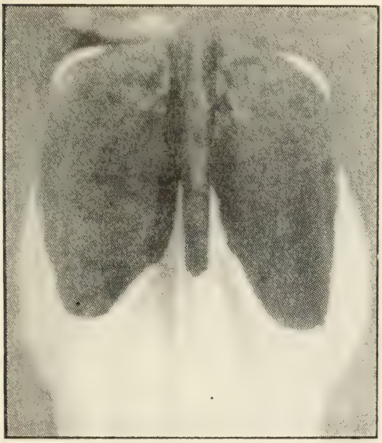


Figure 76, Rear view of the true cow. Note width at pin bones, tail setting and how the inner thigh is cut out.

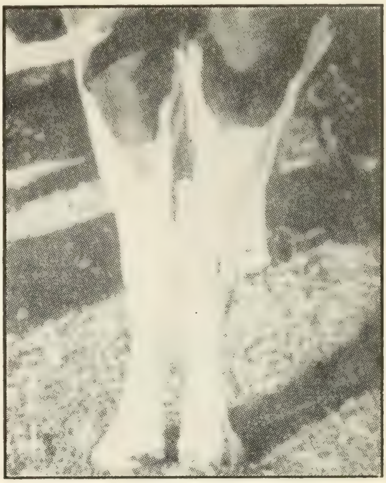


Figure 77, Legs too close together. No room for udder.

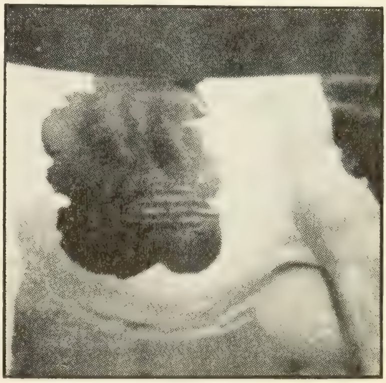


Figure 78, Closer view of the true type mammary veins and barrel

Mammary veins: Large, tortuous, entering large orifices or double extension; with additional developments, such as branches and connections entering numerous orifices. The mammary veins found on both sides of the abodmen are an indication of milk producing tendency. They are the external part of the veining system which carries the blood from the udder back to the heart and lungs. A well developed network of these veins denotes that a large quantity of blood has supplied the milk secreting glands. The mammary veining system develops in varying degrees with each lactation period. The extension of veins on the chest, double branching and a center vein are degrees of development generally found only in the mature animal, but may be indicated in rudimentary form in the case of a heifer. A network of veins on the surface of the udder indicates a high development of the circulatory system in the udder.

Constitution

A strong constitution is indicated by great chest or forequarters development, which demands good depth from top to bottom of the body just back of forelegs. The chest should be deep, wide; well filled and smooth in the brisket; broad between the forearms; full in the foreflanks. Constitution is primarily dependent on breadth between and just back of forelegs; as the organs or respiration and circulation are located in the chest cavity.

The heartgirth should be large and the distance between forelegs should be wide. Thus the foreribs should be well sprung as well as deep. The nostrils should be large and open. The wind pipe should be large. The crops should be well developed. Cows possessing these essentials of good constitutions are able to withstand the strain of heavy milk production over a long period of years and still remain in good health.

In figure 79 strong and weak constitutions are illustrated.

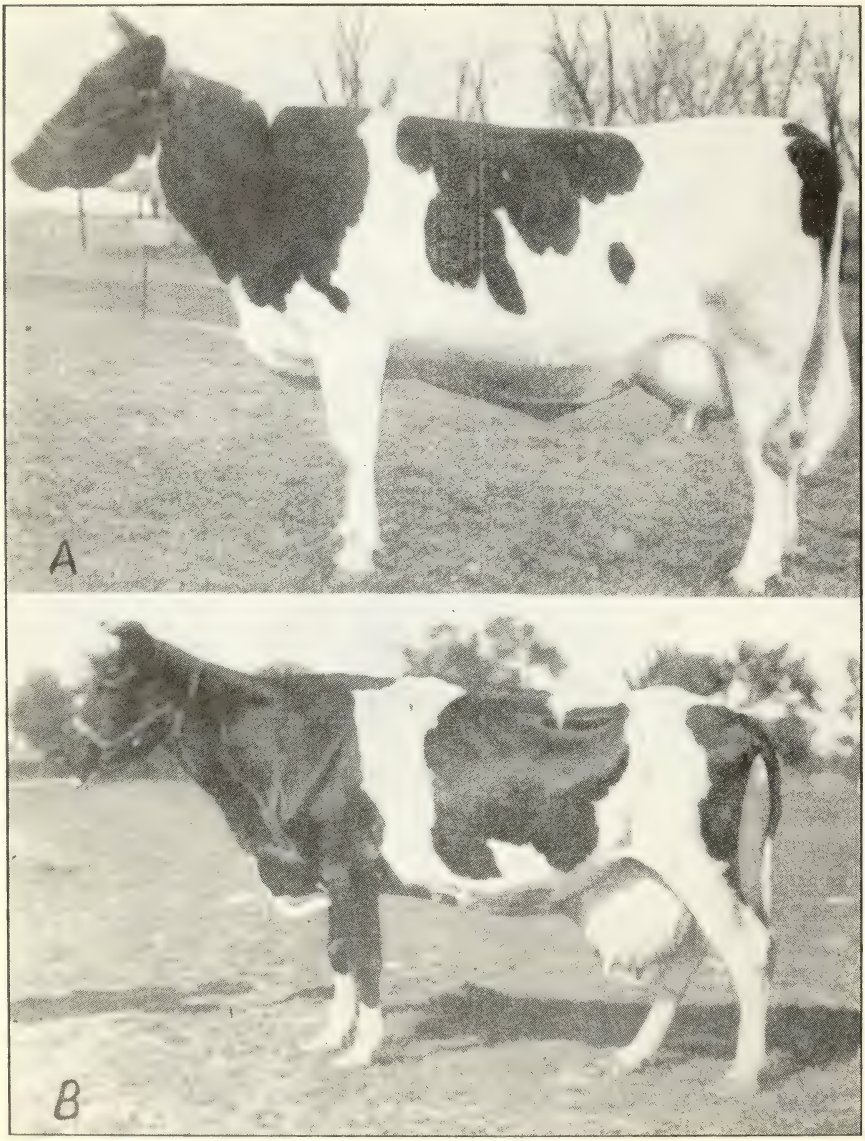


Figure 79, Comparison of constitution.

In order to maintain high production year after year, a dairy cow must possess rugged constitution and physical stability and substance. The two cows shown above are exceptionally good producers. The cow in figure 79-A, has constitution to withstand many years of production, while physical instability may limit the productive years of the cow in figure 79-B.

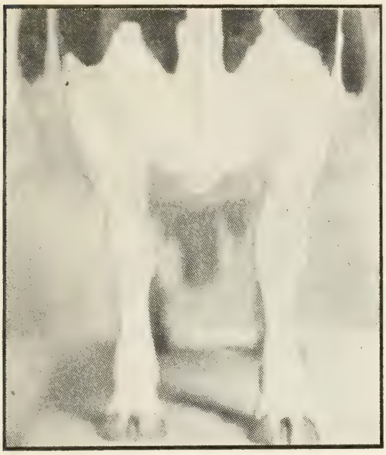


Figure 80, The true type chest. Note breadth between forearms.

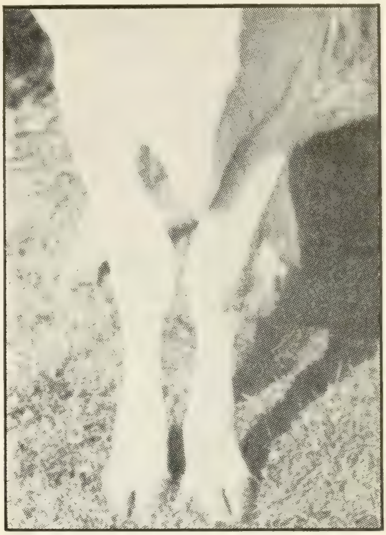


Figure 81, A narrow weak chest, no width between and back of forelegs.

Hindquarters

Loin and hips: Broad, level or nearly level between the hipbones; level and strong laterally; spreading from chine broadly and nearly level; hipbones fairly prominent. The low, narrow loin is associated with the weak back. A broad, level loin strengthens the back and supports the reproductive and milk producing organs. A broad prominent hip indicates strong feminine characteristics.

Rump: Long, broad with roomy pelvis; nearly level laterally; full above the thurls; carried out straight to tail head. The underline of the udder tends to parallel the line of the rump. The length of the rump largely determines the length of the udder. The broad level rump is associated with a broad level udder.

Pinbones: Wide between; nearly level with hips. Narrowness at pinbones makes parturition more difficult and tends to narrowness of rear attachment of udder.

Thurls: High, broad through. High and broad thurls provide roominess in the pelvic region.

Tail head and tail: Strong at base without coarseness; the setting well back; tail long, tapering finely to a full switch. Coarseness at tail indicates lack of quality throughout.

One of the serious faults found in cows with sloping rumps is that, as a rule, the udder tilts forward at an angle similar to that of the slope of the rump. In cows of this type the rear quarters of the udder frequently become overde-

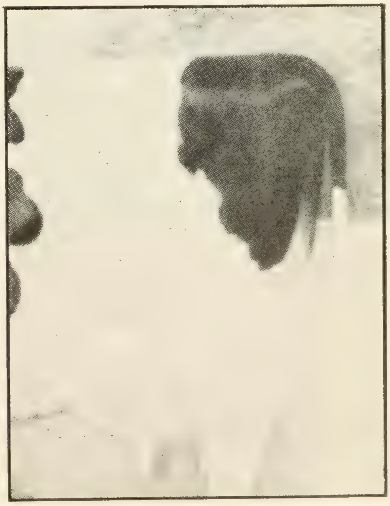


Figure 82, Rear parts of the true type cow veloped, causing the front attachment to break away from the body and the udder to become pendulous. A level rump and an udder with a level floor are shown in figure 82 while figure 83-A and 83-B illustrate a badly sloping rump and an udder suspended at the same angle.

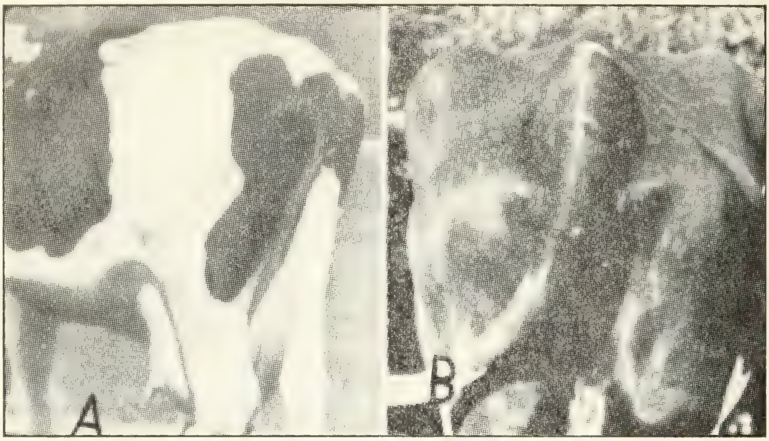


Figure 83, A, Note crosses on hipbones and thurl. Compare with true type. Sloping rump, poor udder. Figure 83, B. Rear view of sloping rump.

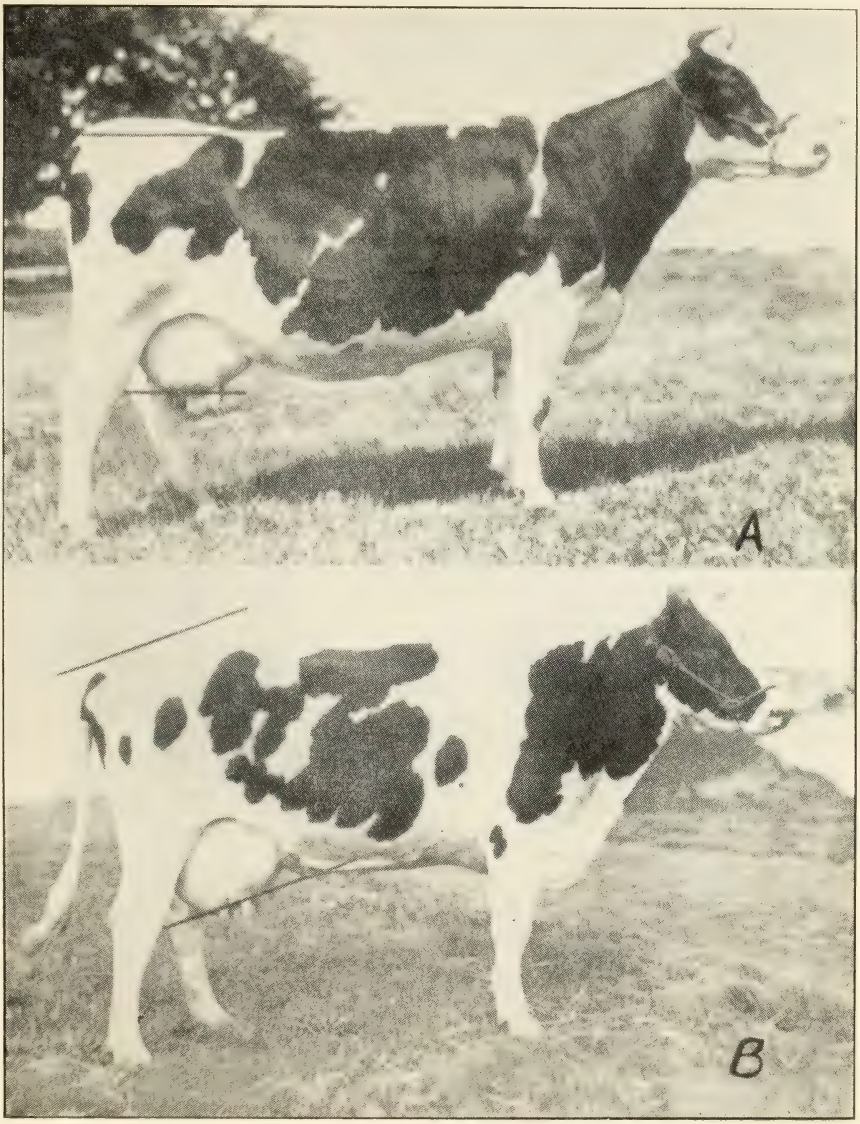


Figure 84, Comparison of Rumps

Size

Under-size is one of the chief defects found among Southern dairy cattle. Other things being equal the larger the animal, the better. Production and size usually go together. However, quality and size are not so closely correlated and in the selection of dairy cattle, one of these factors should not be gained at the expense of the other. Rather a happy medium between the two is desired, that is, good size and plenty of quality along with it. Each breed specifies on the score card desirable weights for the animals of their respective breeds.

Quality

All dairy cattle should posses quality. The hide should be thin, loose and pliable, with good secretion. The bones should be medium sized and not coarse.

A fine, clean bone is always associated with general quality and vigor. A clean cut head and general refinement throughout the animal are other indications of quality.

General Appearance

In addition to the points already discussed, a good dairy cow should present a pleasing general appearance. By this is meant, she should be symmetrical, or with all her parts properly developed and blended together to give the cow the ideal dairy type. Her total length must be proportional to her depth and width, and she must be alert and carry herself gracefully.

Judging Dairy Bulls

In judging dairy bulls, the points indicative of production in the cow such as constitution, capacity, dairy temperament, and breed characteristics, are just as important and should be considered in selecting the dairy bull.

The dairy bull, first of all, must be masculine in appearance. He must have bold appearance, the entire expression being one of vigor, resolution, and masculinity. Masculinity is further indicated by a broad, strong head, eyes full and bold, large, open nostrils, and broad muzzle. The neck should be of medium length, with full crest at maturity, and clean cut at the throat-latch with little or no excess dewlap. The shoulders should be strong and well developed but not coarse. These developments of the head and neck, which are so different from those of the cow, are all indicative of masculinity, which the dairy bull must possess.

Next, special emphasis should be given to constitution. The chest should be deep and wide, with great heartgirth development behind the shoulders, and full development of the crops.

The body of a dairy bull is very important. It should be deep, fairly long, and the ribs should be well sprung. The back should be straight, strong and open jointed, and possess a good spring of ribs. The hips should be moderately broad, and the rump long and level. The thighs should be relatively thin and incurving and the body should be free of any tendency toward beefiness. The rudimentary teats should be placed far apart and be free from the scrotum. The hide should be soft and pliable.

Finally, the bull should possess the breed characteristics, size, quality and color desired for his particular breed.

How to Examine a Class of Dairy Animals

The dairy animals should be lettered A, B, C, D, etc. This may be done by marking these letters on cardboard to hang on the animals or to hang on the attendants leading the animals in the show ring.

It is best to lead the animals in alphabetical order before the judges and to keep them in that order throughout the judging. In leading the animals, the attendant should hold the halter rein about six inches from the cow's head. He should walk beside the cow and not lag behind or walk in front of the cow. He should be on the side of the cow which is opposite from the judge.

The class of animals should be led in a ring about 30 feet in diameter, with the judge in the center of the circle. The animals should be led in one direction for 3 minutes and then in opposite direction for 3 minutes. This enables the judges to see both sides of the animals.

While the animals are being led around the ring, the judge should make careful observation of those exhibiting superior general appearance or dairy type. Individual points such as size, color, length and depth of body, straightness of back and rump, depth of chest, size and shape of udder and breed characteristics are also observed at this time, but they all must be viewed from the standpoint of the whole animal rather than from that of the individual part. During this time the judge must keep in mind the ideal dairy type and be constantly comparing the animals in the ring to this mental picture of the ideal dairy cow.

Next the animals should be lined up a few feet apart, in alphabetical order, to give the judge an opportunity to examine the animals at close range. At this time comparisons are made of such points as to head, width of chest and barrel, width of rear udder, width of rump and pin-bones, and spring of ribs on back. The quality of hair and hide, the texture of the udder and the milk veins are carefully examined. These close inspections are made mainly to confirm the decisions made by the judge when the animals were observed from a distance. These examinations should be made quickly and accurately.

In many judging contests, handling the animals is often prohibited. Under such circumstances it is assumed that there are no defects in any of the animals not visible to the eye. Even when handling is permitted, the animals should only be handled when absolutely necessary to gain information. The judge should approach the animals in a quiet manner, always being gentle and never rough in the actual handling of the animals.

The Jersey Breed

Detailed Description

Jerseys have beautiful heads, very clean cut and breedy in appearance, broad, rather short, with considerable dish of face. Their heads are proportionately shorter and wider than those of other dairy breeds. The muzzle should be wide and the nostrils large and open. The ears should be of medium size, fine and carried alert. The eyes should be large, full, and rather prominent; those of the cow placid in expression; those of the bull bold, indicative of masculinity and vigor. The eyes of Jersey cattle are larger and more prominent than in other breeds. The horns of the cow should be rather small, fine, and incurving; those of the bull medium in size, rather short, strong, and less curving than in the cow. Amber colored or white horns with black tips are preferred. The neck should be of medium length and clean at the throat; refined and clean in the cow; clean, muscular, and with a full crest at maturity in the bull.

The shoulders of the cow should be light, wide through from point to point, but refined and thin at shoulder tops or withers; those of the bull full and strong, with well defined withers. The chest should be deep, fairly wide, and full, with good width between front legs and well filled out in forerib and foreflank. Too frequently the chest lacks proper width. The back should be straight and strong and in the cow the backbone should be prominent. The loin should be broad, strong and carried up in line with back and rump. Some dips or depression over the loin is not uncommon and this is very objectionable.

The barrel of the cow should be deep, wide, and large, the ribs being long and well arched. The barrel or middle of the bull should be moderately long, of good depth and breadth, with strong, rounded and well-sprung ribs. The hips of the cow should be prominent and wide; those of the bull smoother and of medium width compared with the cow. The rump should be long and level and in the cow should be wide throughout, including good width at the pin-bones. Jersey cows generally have good rumps, though desirable width is sometimes lacking. The rump of the bull need not show quite as much width as the rump of the cow, but should be proportionate to size and body. The tail should be refined and long, with good switch, and tail setting should not be coarse nor high, but neat and straight in line with line of rump. In Jersey cattle the rump, thighs and all other parts should be free from undesirable fleshiness, being clean cut and trim throughout. The legs should be straight, refined in bone and joints, strong, and of medium length. Quality and refinement in the legs should be well marked and care should be taken to avoid sickled or bent hind legs. The hide should be loose, mellow, and rather fine.

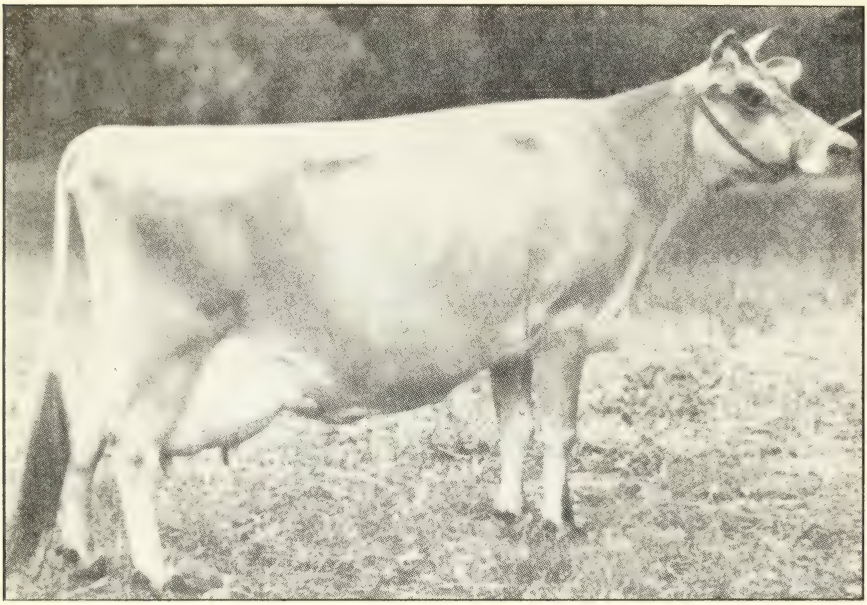


Figure 85, Jersey cow

The scale of points adopted by the American Jersey Cattle Club allots 24 points out of 100 to the udder, 8 points to teats, and 4 points to the milk veins, a total of 36 points for the entire mammary system. The scale of points specifies that the udder should be "large, flexible, and not fleshy; broad, level, not cut between teats; foreudder full and well rounded, running well forward of front teats and firmly attached; rear udder well rounded, well out and up behind, wide, and firmly attached".

The teats of the Jersey should be of medium size, uniform in size, well separated, and squarely placed. The milk veins should be large, long and tortorous, entering large and numerous milk wells. The rudimentary teats of the bull should be well defined and prominent.

Color

The color of Jersey varies, many being of solid color. White markings are true Jersey characteristics and are no indication of admixture of other blood. Soft tints of fawn or cream color are common, though different shades of mouse color, gray, red, and brown are frequently found and some are mulberry black. They may be solid color of any of these shades, or spotted with white. The muzzle, tongue and switch may be black or white, or mixture of black and white.

Size

The Jersey ranges from small to medium in size, It is smaller than the Holstein, Guernsey and Ayrshire breeds. The Jersey scale of points specifies a weight of 1300 to 1600 pounds for bulls and 900 to 1100 pounds for cows.

Quality

Jersey cattle are noted for their refinement and quality. No breed of dairy cattle average as high a degree of quality in head, horn, bone, skin, hair and udder as the Jersey. In some instances refinement is carried to the extreme and this should be avoided.

The Guernsey Breed

Detailed Description

The head of the Guernsey should be of medium size, moderately long, clean cut, with a lean and moderately dished face, bridge of nose straight, broad muzzle, open nostrils, strong jaws, full bright eyes, broad forehead, and horns, that are small at the base, medium in length, inclining forward, not too spreading and yellow in color.

The head of the Guernsey represents a sort of medium between the Jersey and Holstein in length, width and dish. In both sexes the neck should be long, clean at throat, and should blend into shoulders smoothly; in the cow it should be refined and thin, and in the bull it should be masculine with moderately strong crest. Bulls usually show some degree of dewlap, but excessive dewlap is objectionable.

The shoulders should be smooth, with the shoulder blades snugly attached to the underlying ribs. The tops of the shoulders or withers should be refined and sharp in the cow, showing complete absence of any fleshy tendency; bulls and dry heifers may be somewhat less sharp, but should be refined in this region. The chest should be wide and deep with the least possible depression back of the shoulders or in the crops. Forelegs should be wide apart so that ample width of chest is indicated. A straight, strong back and loin is essential for strength as well as beauty. The barrel should be deep and long with well sprung ribs. While a well sprung rib is desired it is not wanted at expense of body depth. As a rule the middle of the Guernsey is lengthy, but is not always large enough in circumference. The hips of the cow should be wide and prominent, those of the bull fairly wide and not too prominent. The rump should be long, wide and level, and wide at pin-bones. The tail should be long and tapering, with full switch, and tail setting neat, free from coarseness, and straight in line of rump. For many years short sloping rumps were found in Guernsey cattle; but breeders have made much improvement in this respect during late years and faulty rumps are less common. The thighs of Guernsey cattle should be thin and wide apart as viewed from behind. The legs should be of medium length, clean and rather refined in bone and joints, and legs should be straight, strong and squarely placed. The hide should be loose and pliable, medium fine, with an oily feeling, and hair should be soft and fine.

The scale of points allots 30 points to the mammary system.

The score-card describes the ideal Guernsey udder as follows: "Uniformly fine in texture, free from meatiness, covered with pliable velvety skin; veins prominent; attachment to body strong, long, and wide, extending well forward, teats of even, convenient size, cylindrical in shape, well apart and squarely placed, plumb. The quality of the udder is apparent in the elasticity, fineness, and abundance of skin in the rear attachment. In the case of heifers, emphasis should be placed on the proper placement and size of teats. A strong attachment of the udder to the body is necessary to assure the carrying of the udder close to the body". The score-card specified high rear udder attachment and that milk veins should be long, tortorous, prominent, branching, with large numerous wells. The rudimentary teats of the bull should be wide apart, squarely placed and of even size. The rudimentary milk veins should be well defined and prominent.

Color

The color of the Guernsey should be some shade of fawn with white markings. Guernseys vary widely in color from the lightest shade of yellowish fawn to brownish or reddish fawn. While all these colors are accepted, the most desired color is the medium shade of fawn with white shield in forehead, white over shoulders and hips, white belly, white legs, white switch and with buff nose. Black muzzles are objectionable. The skin should be a deep yellow inclining towards orange in color, especially discernable inside the ear, at the end of the bone of the tail, around eyes and nose, on the udder and teats and at the base of the horns. Guernseys and Jerseys excel other breeds in ability to absorb and transfer to their butterfat a large proportion of the Carotene in feed which is responsible for this yellow color. The Guernsey breed has the highest color of skin secretion and the greatest natural color of butter of any of the breeds.

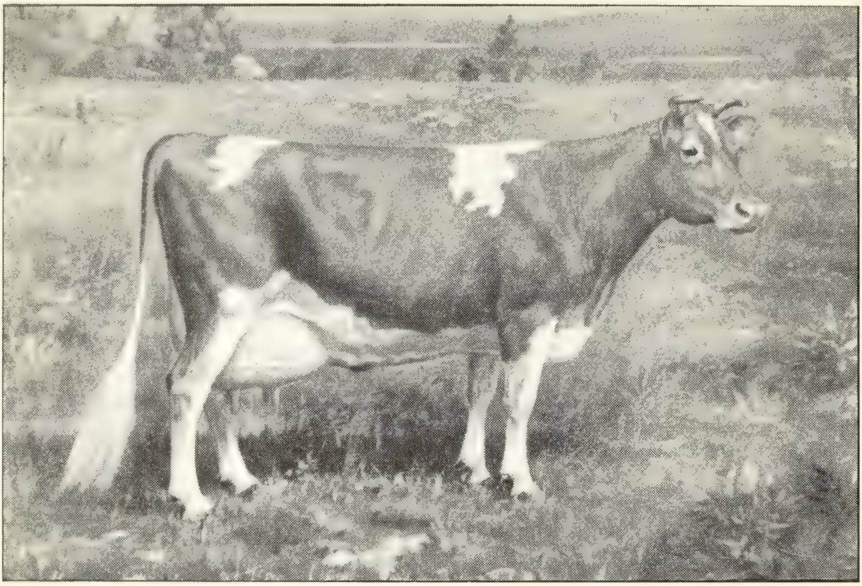


Figure 86, Guernsey cow

Size

The Guernsey ranks between the Holstein and Jersey in size. Mature Guernsey bulls vary in weight from 1200 to 2200 pounds but a weight of 1700 pounds is preferred by most breeders. The cows vary in weight from 800 to 1400 pounds with 1100 pounds being an acceptable weight for a cow of milking condition.

Quality

Although the Guernseys are not equal to the Jerseys in quality they have very mellow, thin, elastic, oily hides, moderately fine hair, and richly colored skin secretions. In comparison to their size, Guernseys may be described as medium in quality of head, horn, and bone.

The Holstein-Friesian Breed

Detailed Description

The head is usually medium size, lean, somewhat long of face, with a straight nose and a broad muzzle and strong jaws. The forehead should be broad and slightly dished between the eyes, nostrils large and open. The ears should be of medium size, of fine texture and carried alert. The eyes should be large, full, mild and bright. The horns, in the cow, should be small and short, tapering finely towards the tips, inclining forward and being well curved inward. Those of the bull should also be short, but heavier than in the cow, and rather straight. The neck should be long, and should be fine and clean at the injunction with the head. The neck should join the shoulders evenly and smoothly and in the mature bull should be well crested, strong and masculine.

The shoulders of the cow should be slightly lower than the hips, smooth and refined over tops. The shoulders of the bull should rise a trifle higher than the hips, should be of medium thickness, stronger, and heavier than in the cow, yet smooth and rounding over the tops. Care should be taken to avoid shoulders that are too heavy and prominent. The ribs should be well sprung. Good spring of ribs is one of the important requirements of approved Holstein-Friesian type. Particularly should the foreribs be well arched so as to fill out crops even with shoulders. The chest should be deep, wide between the front legs, and full in the foreflanks. The back should be straight and strong and should have width without beefiness. The loin should be broad, level and strong; and the hips wide and prominent, though not too prominent, especially in the bull. Probably no part of the Holstein has come in for closer scrutiny during late years than the rump. Too frequently, it has been short and sloping. It should be long and level, wide and free from beefy tendency. The pin-bones should be wide apart and the tail-setting should be straight in line with the rump, free from coarseness, and the tail long and tapering; finely to a full switch. The thighs should be wide, deep, with inside cut out so as to provide ample space for the udder. Too frequently the thighs are rather thick, with more beefiness than is desirable. The udder of the Holstein cow is frequently very large, but often inclined to be pendulant rather than firmly attached, and fore udder sometimes lacks proper extension forward.

The udder should be level, flexible, capacious, extending well forward extension of the milk veins. The teats should be well formed, plump, of convenient size and properly placed. The legs should be of medium length, clean in shank, straight, strong and wide apart. The hide should be of medium thickness, mellow, and loose; and the hair fine and soft.

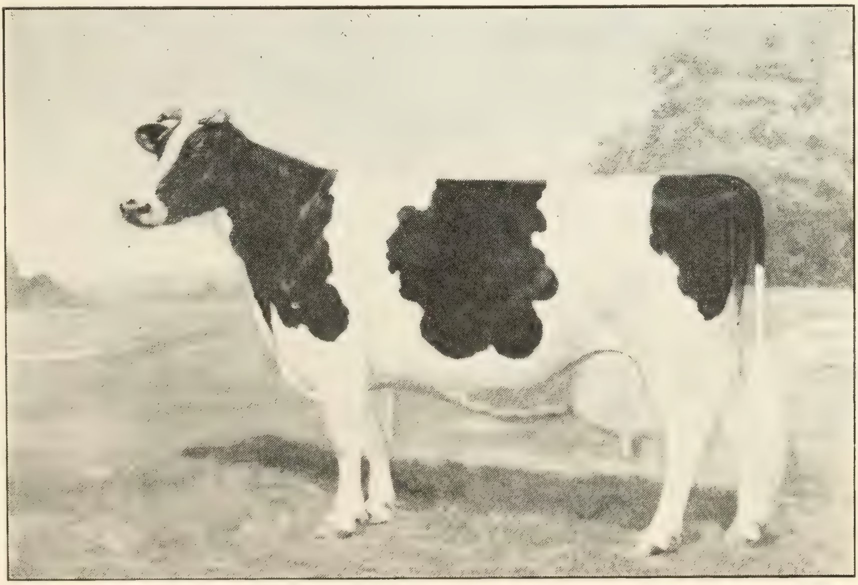


Figure 87, Holstein-Friesian cow

Color

The color of the Holstein-Friesian is black and white. They must be nearly all white or black, **but no solid-colored animal can be registered. They must carry both black and white.** A desirable proportion of black to white is shown in the "true type" published by the Holstein-Friesian Association. The black markings not only should be large but sharply defined, with no inter-mixture or blending of the two colors. Roan is undesirable. The switch of the tail should be entirely white. Black color below knees and hocks is undesirable and may prevent registration.

Size

This is the largest breed of dairy cattle. The weights of Holstein-Friesian cows that have been milking four to six months should be from 1300 to 1600 pounds. These may be classed as medium weights. The mature Holstein-Friesian bull should weigh not less than 2000 pounds and from 2200 to 2400 pounds is much more desirable.

Quality

This is not a particularly refined breed, but it should not show coarseness and roughness. The head should be of medium size and clean cut, the bone medium and clean, the hide mellow and medium in thickness, and the hair rather fine and soft. The skin secretion of the Holstein-Friesian does not show a yellow color.

The Ayrshire Breed

Detailed Description

The Ayrshire head is medium in length, fairly wide, slightly dished between the eyes, lean of face; broad, strong muzzle; prominent, rather lively eyes, medium sized ears, and horns that curve outward and strongly upward, usually turning back at the tips in cows. The horns are set wide apart, are long and large and are often quite heavy in the bulls. The head is strong and wide at the poll and not coarse, though without the refinement found in Jerseys and Guernseys. The head of the bull should have a vigorous, resolute, masculine expression; that of the cow should be mild and feminine. The neck should be moderately long, clean at the throat and well carried. Both sexes are very trim about the neck, being practically free from loose skin.

The shoulders of the cow should be light, wide through from point to point, sharp at withers, and smooth throughout. The chest should be wide, deep, and full. The back should be straight. The loin should be broad, level and strong. Ayrshire cattle are excellent in straightness and strength of top line. The middle should be wide, deep and large. The hind flank should be thin and arching. The hips of the cow should be wide and not project above the level of the back. The hips of the bull are proportionately narrower and smoother. Ayrshire cattle are noted for uniformly straight, square rumps. The rumps should also be long, broad, wide at the pinbones, and not too fleshy. There is a tendency in some individuals to be too fleshy in rump and thighs. The legs are rather short and are usually straight, strong and set well apart both in front and behind. The shanks and joints should be clean, and reasonably fine. The skin should be medium thick, mellow, and elastic, and the hair soft and fine. The hair is somewhat thicker than that of other breeds, but not coarse and wiry. The Ayrshire has a large, full udder that is universally acknowledged to be close to perfection in balance, levelness, shape, attachment, and placement of teats. However, the Ayrshire udder is usually too firm and meaty in texture and this is very objectionable. The teats are squarely placed and uniform in size, but often are too small. The milk veins and milk wells of the breed average good in size, length and capacity. The Ayrshire score-card gives 30 points out of 100 to the mammary system, and emphasizes size and shape of udder; attachment of udder; texture of udder; size and placement of teats and veining and milk wells.

Color

The Ayrshire may be red of any shade, mahogany, brown, or these with white or pure white. Black markings and brindle sometimes occur but are strongly objectionable. The most desirable color is white with dark red markings of a rich mahogany shade. Each color should be distinctly defined.

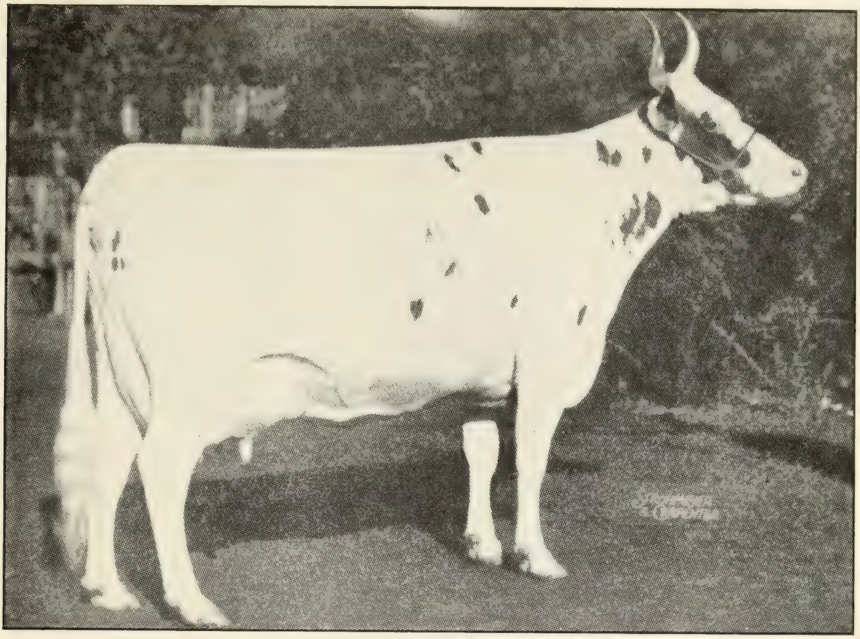


Figure 88, Ayrshire cow

Size

Mature Ayrshire cows should weigh from 1100 to 1400 pounds depending on period of lactation. Bulls four years old and over in good breeding condition should weigh from 1700 to 2000 pounds.

Quality

The breed ranks medium in quality. The general appearance in head, bone and throughout is one of strength, rather than high refinement. They are not rough or coarse, however, but are in fact rather smooth cattle, possessing a degree of ruggedness without coarseness.

References: Mimeograph Agricultural Education Department, "Dairy Cattle Judging and Selection," Raleigh, North Carolina.

Breed Associations.

Contestant's Score Card for Milk

Contestant's No. ______________________ Sample No. ______________________

	Student	Official	GRADE	
			Score	Criticism
1. Flavor and odor (25)				
2. Sediment (10)				
3. Bottle and cap (5)				
Total (4)				
Placing				
Grade on criticism				
Total grade				

CRITICISMS

FLAVOR AND ODOR

Bitter
Cardboard
Cooked
Cowy
Disinfectant
Feed
Flat
Garlic
High Acid
Metallic
Musty
Rancid
Salty
Sour
Unclean
Watery
Weedy

SEDIMENT

Score cottons as per photographs, p. 17, Circular 384 (revised 1929) U. S. Department of Agriculture.

BOTTLE AND CAP

Absorbent cap protector
Chipped mouth
Dirty bottle
Leaky cap
Lip not protected
Lip partially protected
Loose cap cover
Not full

(On back of Score Card)

Flavor and Odor

Score	Description
23 and above	Supreme quality
21 to 23	Lacking special high flavor, flat, very slight feed, slightly cooked
18 to 21	Cooked, feed, salty, slightly cowy, slightly metallic
12 to 18	Strong feed, weedy, bitter, strong, musty, cowy, metallic, slightly rancid (cappy or cardboard)
12 to 0	Rancid, strong cowy, high acid
0	Sour, putrid, or any flavor sufficiently strong to render unfit for market purposes

Sediment

Score cottons as per description and photograph on pages 16 and 17, Circular 384, Rev. 1929, United States Department of Agriculture, which circular may be obtained on application to the Office of Information in the department. Smallest cut given 0.1 point. No criticisms required.

Bottle and Cap

Score 5
Score 4.9 or less
Dirty bottle
Absorbent cap protector
Not full
Loose cap cover
No criticism
Lip not protected
Lip partially protected
Leaky cap
Chipped mouth

INSTRUCTIONS: Students will score each item and place check mark to right of defect. If defect is not listed write it in blank space.

NOTE: Normal score on flavor .... 18 to 23.5
Normal score on sediment .... 0 to 10
Normal score on bottle and cap .... 3 to 5

Suggested Cuts on Bottle and Cap

Bottle not full	0.25 to 1.0
Dirty bottle	.5 to 2.0
Cap poorly seated or leaky (if uncovered)	.1 to 1.0
Chipped lip	.1 to .5
Pouring lip unprotected	1.0
Pouring lip partially protected	.25 to .75
Cap covering loosely fastened	.25 to .50
Cap covering non-waterproof	.25 to .75

PART IV

JUDGING POULTRY FOR PRODUCTION AND EXHIBITION

Birds arranged in display coops for judging are constantly changing the position of their bodies. They appear to a much better advantage in one position than in other positions. Each bird should be given credit for the appearance in the best position it can be made to assume. Therefore each bird should be posed before judgment is passed upon it. When the bird has been properly posed the person placing the class should retire a few feet to obtain the best view of the individual and the class.

Each bird in the ring should be carefully observed and the ring tentatively placed before handling the fowls. To make a detail examination of the fowls before getting a general perspective often causes undue emphasis to be given to minor details and defects. The animal as a whole is being judged, therefore undue emphasis should not be placed on minor details.

A definite procedure should be followed in the examination of the bird. A good plan is to begin with the head, followed by an examination of the breast, body, abdomen, legs, and plumage, noting both surface color and under color, quality and condition. Standard disqualifications should also be detected during the examination.

In handling the hens for judging, all birds should be held in a similar position. The correct way in holding for examination is to allow the bird to rest on the palm of the hand with the index finger between the legs, the thumb around one thigh and the remaining three fingers around the other. To remove a bird from an exhibition coop reach both hands into the coop, place the right hand over the back of the bird and grasp with the left hand in the manner indicated above. Remove the bird from the coop head first.

In judging poultry for production the essential points to be considered are constitutional vigor and temperament, body conformation, including head and adjuncts, quality and condition. Breed and variety characteristics in the flock are also important in order to maintain standard appearance and uniformity of market products, both poultry and eggs.

1. Constitutional Vigor and Temperament:

Constitutional vigor and temperament are those characteristics which enable a bird to stand up under the strain of egg production over a long period of time. These are indicated by general health, activity, energy, erectness of carriage, alertness, rugged yet refined in head and body conformation.

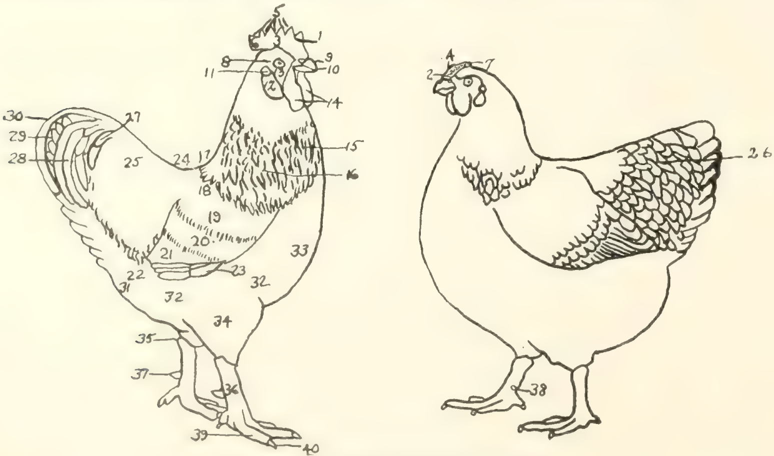


Figure 89, Showing points of chickens

1. Single comb
2. Rose comb
3. Points
4. Blunt points
5. Serrations
6. Blade
7. Spike
8. Eye
9. Nostril
10. Beak
11. Ear
12. Earlobe
13. Face
14. Wattles
15. Neck
16. Hackle
17. Cape
18. Shoulder
19. Wing-bow
20. Wing-bar
21. Wing-bay (secondaries)
22. Primaries
23. Pinion feathers
24. Back
25. Saddle
26. Cushion
27. Tail-coverts
28. Lesser sickles
29. Main tail feathers
30. Greater sickles
31. Fluff
32. Body
33. Breast
34. Thigh
35. Hock Joint
36. Shank
37. Horny spur
38. Rudimentary spur
39. Toe
40. Toe nail

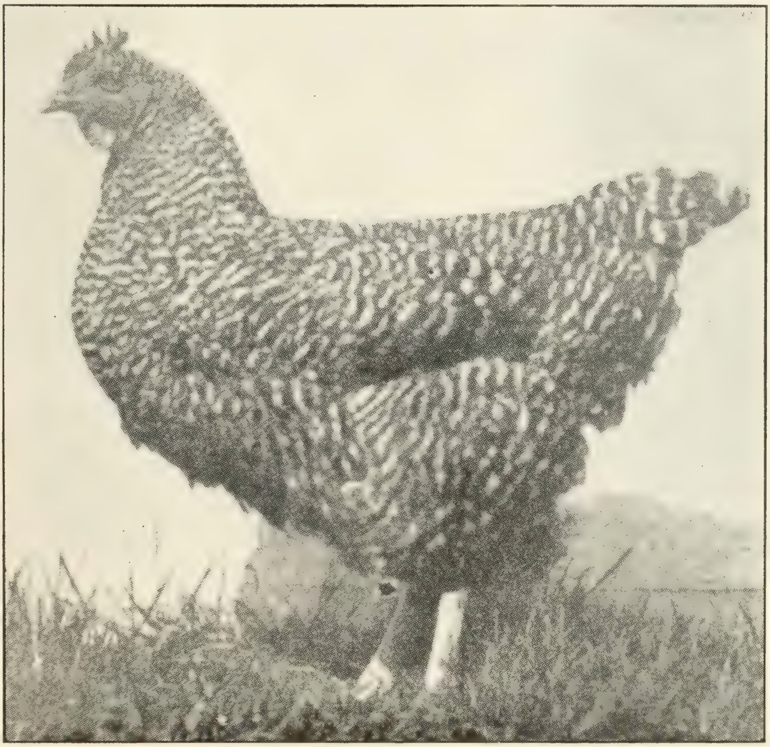


Figure 90, A well developed hen

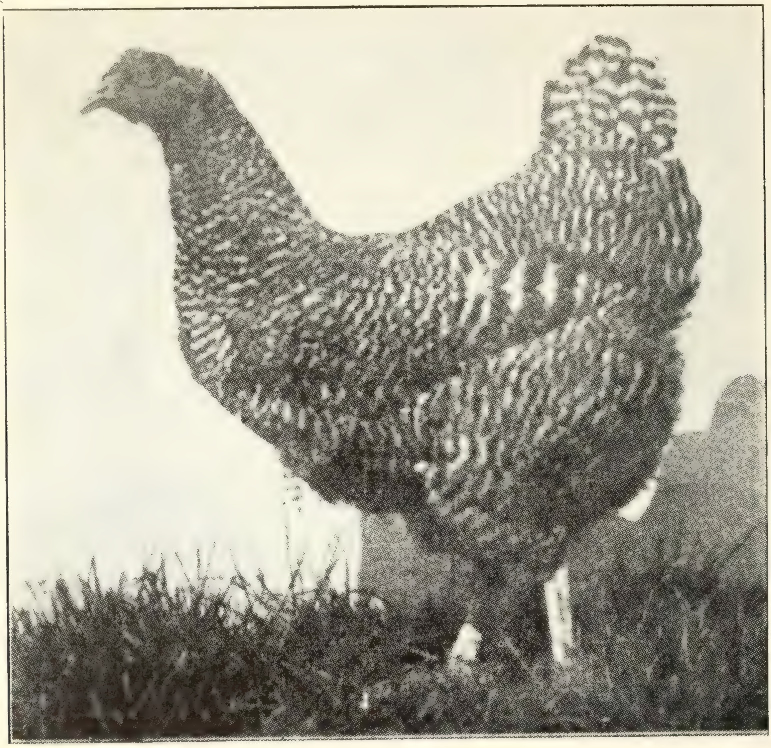


Figure 91, A poorly developed hen

Placing Card for Poultry

Contestant's Number__________ Class__________

PLACING ON COMPARATIVE POINTS	First	Second	Third	Fourth	Grade
1. Constitutional vigor and temperament: Alertness, activity; size, shape and prominence of eye; sex characteristics					
2. Breed and variety characteristics: Size, trueness to type, color of plumage; symmetry; freedom from serious defects					
3. Conformation: Shape of head and beak, width, length, and shape of back; length and depth of body; angle of tail; width and depth of breast					
4. Quality and condition: Texture of skin; comb, and wattles; pigmentation; molt; fleshing					

TOTAL

(A) Average of the above grades

FINAL PLACING	First	Second	Third	Fourth	Grade
(B) Final Placing Order					

FINAL GRADE: A+B÷2=

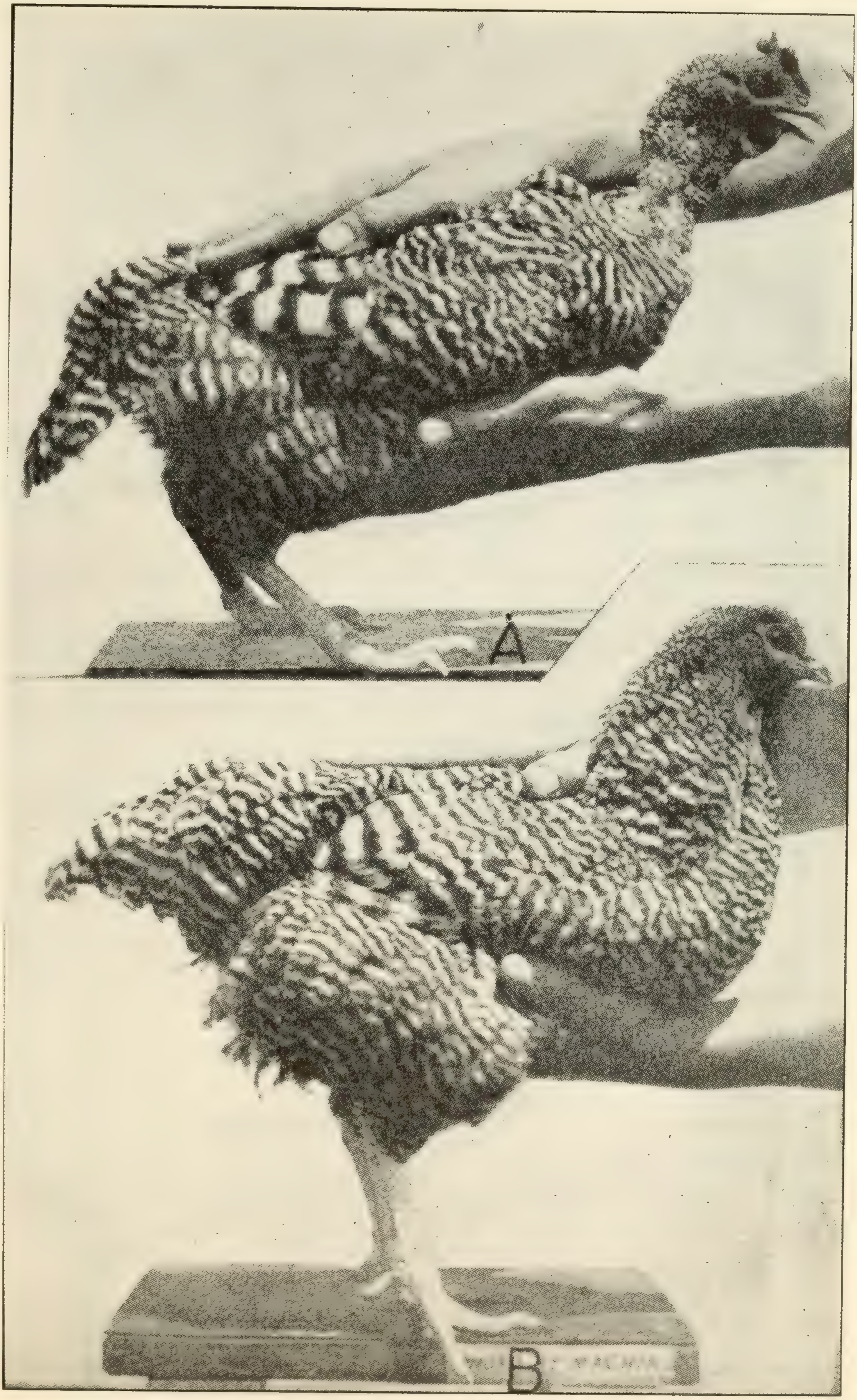


Figure 92, Illustrations showing method of determining relations of keel to back. In the high producer (A) the finger tips of the lower hand point downward. In the non-producer (B) the finger tips of the lower hand point toward the tail. The first years production records of these hens are: (A), 187 eggs, (B), 97 eggs.

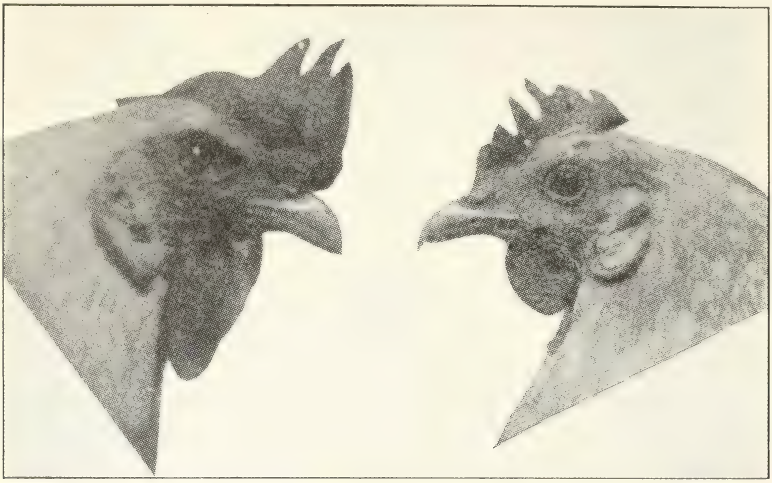


Figure 93, Left: Head of high producer. Comb and wattles are full, bright, and velvety; beak short, well curved; eye bright, prominent; beak, eye-ring and ear-lobe pale in color. Right: Head of poor producer. Comb and wattles are small, shrunken, scaley; eye dull, sunken; beak, eye-ring, ear-lobes and shank have yellow color.

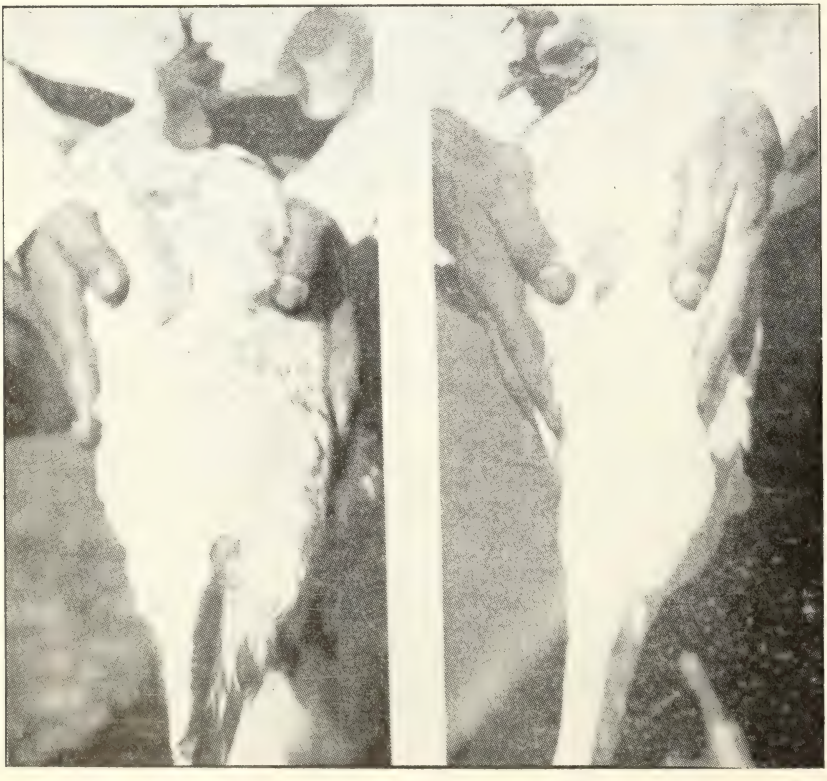


Figure 94, Left: Back of good producer. Note the breadth, and how it extends to the rear. Right: Back of poor producer. It is narrow and tapering.

2. Conformation:

The head should be medium in length, deep, broad, clean cut in appearance, and free from excess flesh. The beak should be medium in length, and strong. The eyes should be large, full bright and prominent. The comb and wattles should be well developed, medium in size, fine in texture and bright red in color when laying. The ear lobes should be smooth, medium in size and conform to breed requirements in color. The neck should be of medium length and strong.

The body should be long, deep, wide, properly balanced and conform to the size and type for the breed. The back should be long and wide with uniform width to the tail. The breast should be full and round, the body deep, the keel bone long and straight, and the abdomen well developed. When in laying condition, the pubic bones should be wide apart (two or more fingers in width) and the distance from the pubic bones to the keel deep (three or more fingers.) The tail should be fully developed and properly carried for the breed. The legs should be straight, strong, and medium in length. The toes should be straight, strong and well placed.

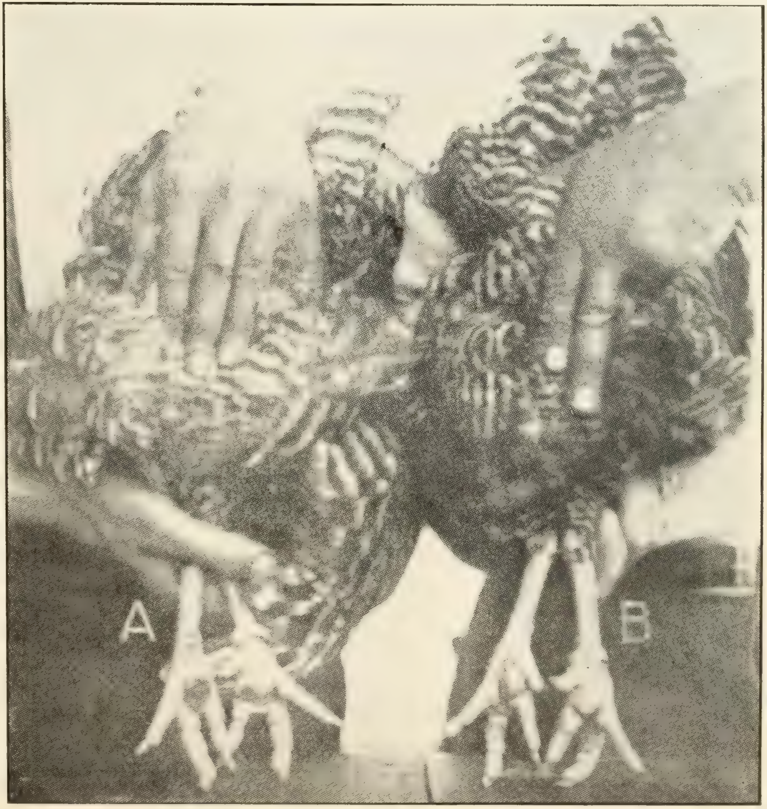


Figure 95, Illustration showing the width between the pubic bones of a laying hen (A) and of a non-laying hen (B)

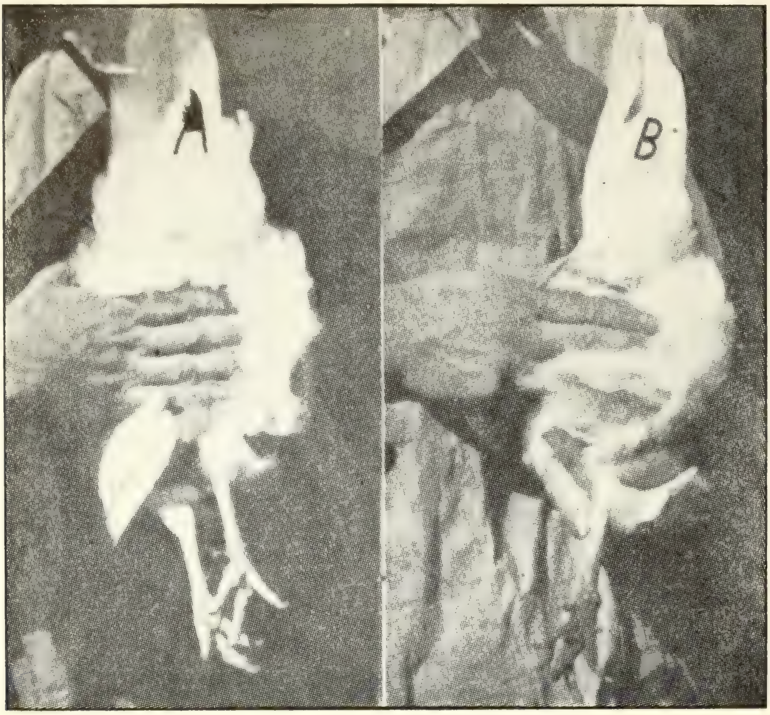


Figure 96, Body Capacity (A) very good; (B) very poor

3. Quality and Condition

Quality is indicated throughout the bird. Evidences of quality are texture of comb and wattles, pliability of skin, thickness of pubic bones, softness of abdomen, flatness of shanks, and fineness of scales on shanks.

In condition, the bird should be well fleshed at all times. When laying, all yellow skin breeds will show bleaching in the skin and body parts. Birds which have been in continuous laying for a long period of time will be completely bleached in the skin and body parts. When laying ceases, the yellow pigment returns if the birds are receiving feeds which contain yellow pigment.

Molting or the renewal of feathers occurs normally once a year in laying birds. Very few feathers are molted during egg production except in the case of the highest producing hens. Hens which have been in production over a long period of time have old plumage, worn in appearance. The best producing hens molt in the fall and winter while poor producers molt early in summer.

4. Breed and Variety Characteristics

The various breeds are distinguished by their size and shape. The birds of any breed should conform as nearly as possible to standard weight and type. Comb color and pattern are variety characteristics. These should meet the requirements of the standard. Certain defects of conformation and feathering disqualify a bird as standard-bred.

Judging for Present Production

Character	Laying Hen	Non-Laying Hen
Vent	Large, dilated, oblong, moist	Small, contracted, round, dry
Pubic bones	Flexible and wide apart	Rigid, close together
Comb	Large, red, full, glossy	Small, pale, scaly
Wattles and lobes	Prominent, soft, smooth	Inconspicuous, rough and dry

Judging for Past Production

	Long Laying Period	Short Laying Period
Vent	Bluish white	Flesh colored
Eyelids	Thin and edges white	Thick, yellow tinted
Eye	Prominent, keen, sparkling	Listless, sunken
Earlobes	Enamel white	Yellow tinted
Beak	Pearly white	Yellow tinted
Face	Clean cut, sunken	Full, well fleshed, yellowish
Shanks	White, flat, thin, creased	Yellow, round, smooth
Plumage	Worn, soiled, lifeless	Signs of molting, loose-feathered

Judging for Intensity of Production

	High Rate	Low Rate
Keel	Slopes downward	Slopes upward
Pubic bones	Tips thin, point straight out	Tip thick, curved in
Capacity	Four to five fingers	Two fingers
Abdomen	Soft, pliable, dilated	Fatty, hard, contracted
Lateral processes	Prominent, pointed outward	Hard to find, pointed inward
Skin	Soft, thin, loose, silky	Thick, dry, underlaid with fat

General Disqualifications

1. **Deformities**—Deformed beaks, crooked backs, a wing showing clipped flights or secondaries or both, a slipped wing, a split wing, twisted feather or feathers in wing or tail. Entire absence of main tail feathers, decidedly wry tails, a decided squirrel tail.

2. **Weight**—In Barred Rocks and Rhode Island Reds an individual falling more than two pounds under standard. In White Leghorn males more than one to one and one-half pounds under weight and females more than one pound under weight.

3. **Comb**—Lopped comb in Barred Rocks and Rhode Island Reds. Split combs. Side sprig on all single combs. Absence of spike in Rose Comb varieties.

4. **Head and Adjuncts**—Positive enamel white in the face of Leghorn cockerels and pullets. Positive enamel white in the ear lobes of males or females of Rhode Island Reds, Barred Rocks or Wyandottes.

5. **Shanks and Toes**—Stubs or feather-like growth on the shanks, feet or toes of Leghorns, Rocks, Red or Wyandottes. Any down, stubs, or feather-like growth on the hocks that is disconnected from the feathers on the thigh. Web-feet, absence of spurs on cocks, more or less than four toes.

6. **Color**—Shank, shanks, foot, feet, or toes of color foreign to the breed. Red or yellow in the plumage of any black variety. Black in quills of primaries or secondaries of white varieties. Foreign color in any part of the plumage of white varieties, except slight gray ticking.

Scale of Points Used in Scoring Birds in Exhibition Judging

	White		Solid Color Other than White		Parti Color	
	Shape	Color	Shape	Color	Shape	Color
1. Symmetry	4		4		4	
2. Weight or size	4		4		4	
3. Condition and vigor	10		10		10	
4. Comb	5		5		5	
5. Beak	2	1	2	1	2	1
6. Head	3	1	3	1	3	1
7. Eyes	2	2	2	2	2	2
8. Wattles	2		2		2	
9. Earlobes	2	2	2	2	2	2
10. Neck	3	3	2	4	1	5
11. Wings	5	3	4	4	3	5
12. Back	8	4	7	5	6	6
13. Tail	5	3	4	4	4	4
14. Breast	7	3	5	5	5	5
15. Body and Fluff	5	3	5	3	4	4
16. Legs and Toes	5	3	5	3	5	3
	72	28	66	34	62	38

Breed Description

1. Plymouth Rock

The Plymouth Rock breed of poultry is very important in America. The first of this breed were exhibited in America at Boston, Massachusetts in 1849. There are several varieties of the Plymouth Rock breed: namely, Barred, White, Buff, Silver Penciled, Partridge, Columbian and Blue Plymouth Rocks.

Detail Characteristics of Male and Female

Comb: Single, small proportionate to size of specimen; set firmly on the head; straight, upright; evenly serrated, having five well-defined points, those in front and at rear being somewhat smaller and shorter than the other three in the female while with the male those in front and at rear a little smaller than the other three, giving the comb a semi-oval appearance when viewed from the side; fine in texture, blade not conforming too closely to head.

Beak: Stout, comparatively short, regularly curved.

Head: Male: Moderately large; face, smooth. Female: Moderately large and broad, medium in length; face, smooth.

Eyes: Large, full, prominent.

Wattles: Male: Moderately long, nicely rounded at lower edges, uniform, fine in texture, free from folds or wrinkles. Female: Small, well-rounded, uniform, fine in texture, conforming to size and shape of head.

Ear-Lobes: Male: Oblong, smooth, hanging about one-third the length of wattles. Female: Oblong in shape, smooth.

Neck: Male: Rather long, moderately well-arched, having abundant hackle flowing well over shoulders. Female: Medium in length, nicely curved and tapering to head, where it is comparatively small; neck feathers moderately abundant, flowing well over shoulders with no apparent break at juncture of neck and back.

Wings: Of medium size, well foldered and carried without drooping; fronts, well covered by breast feathers and points well covered by saddle or back feathers; primaries and secondaries, broad and overlapping in natural order when wing is folded.

Back: Male: Rather long, broad its entire length, flat at shoulders, nearly horizontal from neck to saddle, where there is a slight concave sweep to tail; saddle feathers, rather long, abundant, filling well in front of tail; feathers moderately broad. Female: Rather long, broad in its entire length, flat at shoulders, rising with a slightly concave incline to tail; feathers moderately broad.

Tail: Male: Of medium length, moderately well spread, carried at an angle of thirty degrees above the horizontal, forming no apparent angle with the back; main-tail feathers, broad and overlapping; sickles, well-curved, covering tops of main-tail feathers, conforming to the general shape of the tail; lesser sickles and tail-coverts, of medium length, nicely curved and sufficiently abundant to almost hide the stiff feathers of the tail when viewed from front or side. Female: Of medium length, fairly well-spread, carried at an angle of twenty degrees above the horizontal, forming no apparent angle with the back; tail-coverts, well developed; main-tail feathers, broad and overlapping.

Breast: Broad, full, moderately deep, well-rounded.

Body and Fluff: Body, rather long, broad, deep, full, straight, extending well forward, connecting with breast so as to make no break in outline; fluff, moderately full.

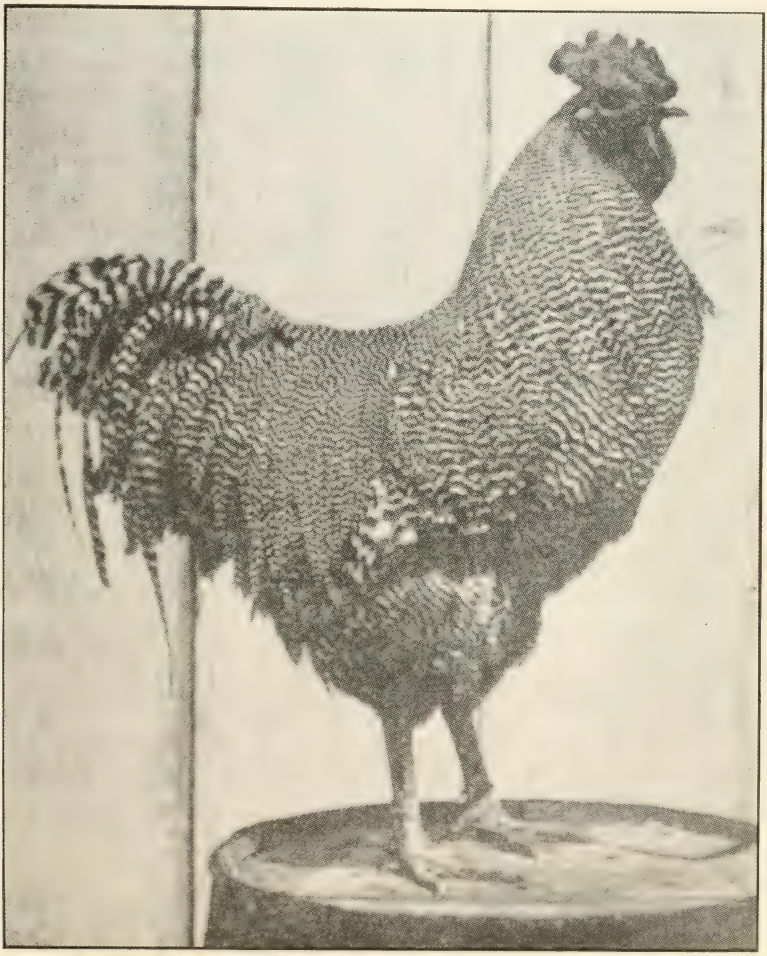


Figure 97, Barred Plymouth Rock Male

Legs and Toes: Legs, set well apart and straight when viewed from front; lower thighs, large, of medium length and well-feathered, smooth; shanks, of medium length, smooth, straight, stout; toes, of medium size and length, straight, well-spread.

Barred Plymouth Rocks

Disqualifications: Red or yellow in any part of plumage; two or more solid black primaries, or two or more solid black secondaries, or two or more solid black main-tail feathers; shanks other than yellow.

Color of Male and Female:

Comb, face, wattles and ear-lobes: Bright red

Beak: Yellow

Eyes: Reddish bay

Shanks and Toes: Yellow

Plumage: Male: Grayish white, each feather crossed by regular parallel, sharply defined, dark bars that stop short of positive black; free from shafting, brownish tinge or metallic sheen; the light and dark bars to be of approximately equal width, in number proportionate to the length and width of the feathers, and to extend throughout the length of feathers in all sections of the fowl; each feather ending with a narrow, dark tip; the combination of overlapping feathers giving the plumage a bluish appearance and of an even shade throughout.

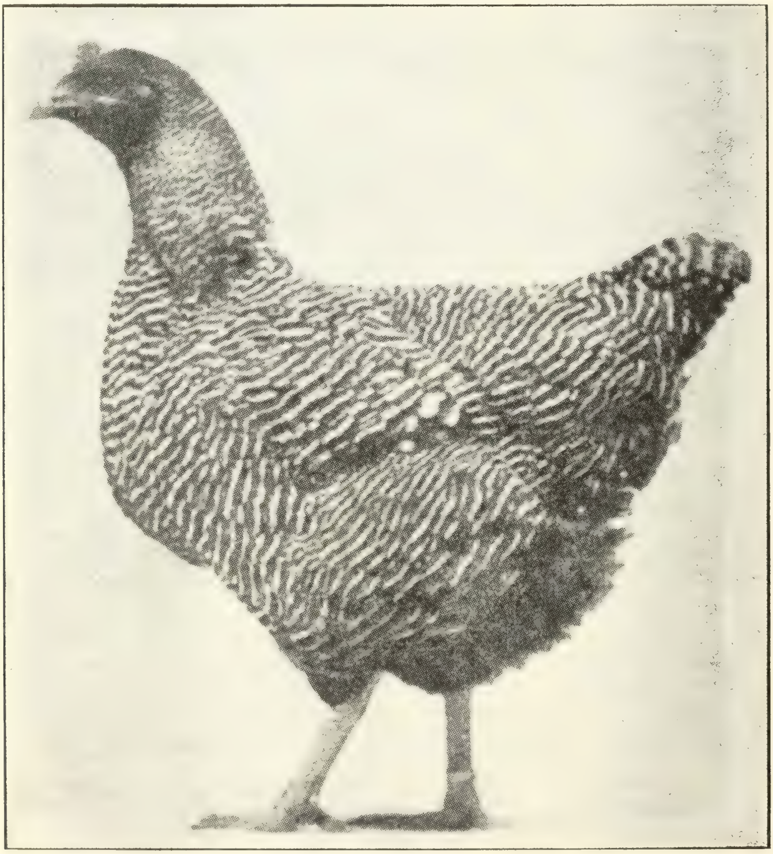


Figure 98, Barred Plymouth Rock Female

Female: Grayish white, each feather crossed by regular, parallel, sharply defined, dark bars that stop short of positive black; free from shafting, brownish tinge or metallic sheen. The light bars, in all sections of the fowl shall be in numbers proportionate to the length and breadth of the feathers; each feather ending in a narrow, dark tip; the combination of over-lapping feathers giving the plumage a bluish appearance and of an even shade throughout.

2. Wyandottes

The true origin of the Wyandotte breed is not definitely known. The following are varieties of Wyandottes: Golden-Laced, White, Buff, Black, Partridge, Silver Penciled and Columbian.

Detail Characteristics of Male and Female:

Comb: The comb of both the male and female are similar, that of the female being much smaller than that of the male. Rose: low, firm on head; top, free from hollow center, oval, surface covered with small, rounded points; tapering to a well-defined point at rear; the entire comb curving to conform to the shape of skull.

Beak: Short, well-curved.

Head: Short, round, crown broad; face, smooth and free from small feathers.

Eyes: Full, round, prominent.

Wattles: Male: Moderately long, nicely rounded at lower edges, uniform, fine in texture, free from folds or wrinkles. Female: Fine in texture, well rounded.

Ear-Lobes: Oblong, well-defined, hanging about one-third the length of wattles; smooth in the male. With the female they are oblong in shape, well-defined.

Neck: Short, well-arched, hackle or neck feathers abundant.

Wings: Medium in size, well-folded; carried not too closely to body, and without drooping; sides, well-rounded; primaries and secondaries, broad and overlapping in natural order when wing is folded.

Back: Male: Medium in length, broad its entire length, flat at shoulders; saddle, broad, full, rising with concave sweep to tail; saddle feathers, abundant. Female: Medium in length, broad its entire length, flat at shoulders; rising in a concave sweep to a broad; slightly rounded cushion, which extends well on to main-tail; plumage abundant.

Tail: Male: Short, well spread at base, carried at an angle of forty degrees above the horizontal; sickles, moderately long, curving gracefully and closely over tail; coverts, broad, abundant, filling out well in front, hiding the stiff feathers; main-tail feathers, broad and overlapping. Female: Short, well-spread at base, carried at an angle of thirty degrees above horizontal; coverts, broad, abundant; main-tail feathers, broad and overlapping.

Breast: Broad, deep round.

Body and Fluff: Body, medium in length, deep, round; fluff, fairly well developed but not so abundant as to hide profile of hocks.

Legs and Toes: Legs, set well apart and straight when viewed from front; lower thighs, short, stout, showing outlines when viewed sideways, well-covered with smooth feathers; shanks, moderately short, well-rounded; toes, straight, well-spread.

White Wyandottes

Disqualifications: Shanks other than yellow.

Color of Male and Female:

Comb, face, wattles, and ear-lobes: Bright red

Beak: Yellow

Eyes: Reddish bay

Shanks and toes: Rich yellow

Plumage: Web, fluff, and quills of feathers, in all sections, pure white

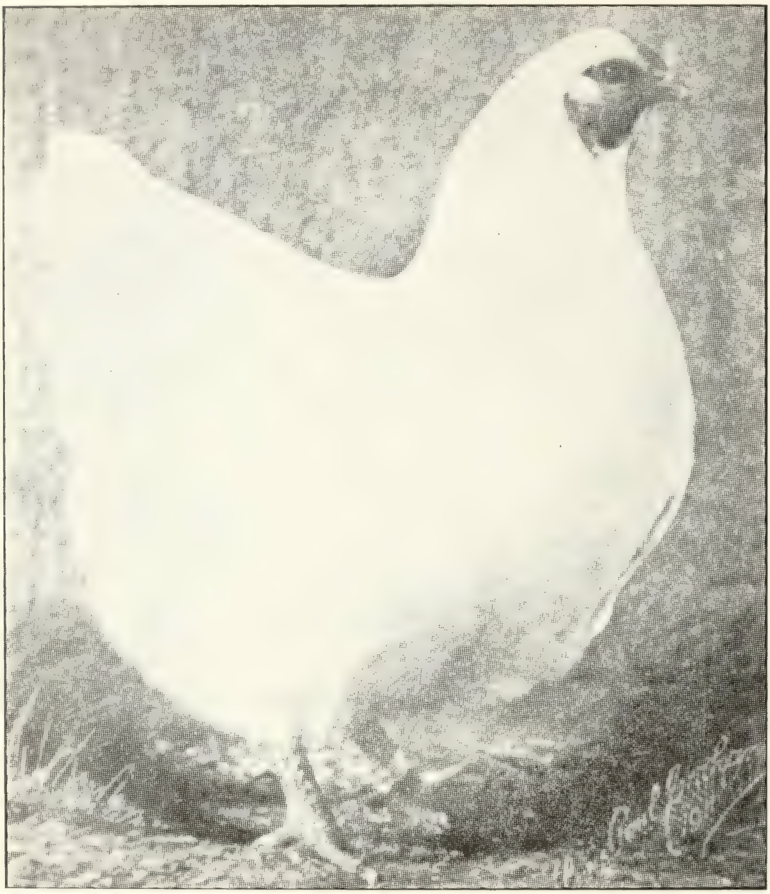


Figure 99, White Wyandotte Female

3. Rhode Islands

The origin of this breed dates back about eighty years to a fowl bred in that section of New England which is located between Narragansett Bay and Buzbard's Bay. There are two varieties: Rhode Island Reds and Rhode Island Whites.

Detail Characteristics of Male and Female:

Comb: Single; medium in size, set firmly on head, perfectly straight and upright, with five even and well-defined points, those in front and rear smaller than those in center; in the male there is considerable breadth where the comb joins the head; blade, smooth, inclining slightly downward but not following too closely the shape of head.

Rose Comb: Male: Low, firm on head; oval, free from hollow center, surface covered with small rounded points, terminating in a spike at the rear, the spike dropping slightly but not conforming too closely to the shape of head. Female:

Low, free from hollow center, set firmly on head, much smaller than that of male and in proportion to its length, narrower; covered with small points and terminating in a small, short spike at the rear.

Beak: Medium length, slightly curved.

Head: Moderate in length, fairly deep, inclined to be flat on top rather than round; face clean-cut, skin fine in texture, free from wrinkles.

Eyes: Large, full, prominent.

Wattles: Male: Of medium size, uniform, free from folds or wrinkles. Female: Of medium size, regularly curved.

Ear-Lobes: Oblong, well-defined, smooth.

Neck: Of medium length, hackle, abundant, flowing over shoulders in male, moderately full feathered.

Wings: Male: Of good size, well-folded, carried horizontally; primaries and secondaries, broad and overlapping in natural order when wing is folded. Female: Rather large, well-folded; fronts, well covered by breast feathers; flights, carried nearly horizontally; primaries and secondaries, broad and overlapping when wing is folded.

Back: Long, moderately broad its entire length, carried horizontally; saddle, in male, moderately broad, feathers of medium length, moderately abundant, blending into tail.

Tail: Male: Of medium length, well spread, carried at an angle of forty degrees above the horizontal; sickles of medium length, extending slightly beyond main-tail feathers; lesser sickles and tail-coverts, of medium length, well feathered; main tail feathers, broad and overlapping. Female: Of medium length, moderately well-spread, carried at an angle of thirty degrees above the horizontal; main-tail feathers, broad and overlapping.

Breast: Moderately deep, full, well-rounded.

Body and Fluff: Body, long, broad, moderately deep, straight, extending well forward, giving body an oblong appearance; feathers carried close to body; fluff, moderately full.

Legs and Toes: Legs, set well apart, straight when viewed from front; lower thighs, of medium length, well-feathered, smooth; shanks, of medium length, smooth; toes of medium length, straight, well-spread.

Rhode Island Reds

Disqualifications: One or more entirely white feathers showing in outer plumage; shanks and feet other than yellow or reddish horn.

Color of Male and Female:

Comb, face, wattles, and ear-lobes: Bright red

Beak: Reddish horn

Head: Plumage, brilliant red

Eyes: Reddish bay

Neck: Male: Rich, brilliant red; plumage on front of neck, rich red. Female: Rich red, with slight ticking of black, confined to tips of lower neck feathers; feathers on front of neck, rich red.

Wings: Fronts and bows, rich brilliant red; coverts, red, primaries, upper webs red, lower webs black and narrow edging of red; primary coverts, black edged with red; secondaries, lower webs red, the red extending around end of feathers sufficient to secure a red wing-bay and lacing the upper portion of upper webs, this color growing wider in shorter secondaries; remainder of each black, feathers next to body being red on surface so that wing when folded in natural position shall show one harmonious red color.

Tail: Male: Main-tail feathers, black; sickle feathers, rich, lustrous greenish black; coverts, mainly greenish black, red as they approach the saddle. Female: main-tail feathers, black; the two top feathers may be edged with red.

Breast: Rich red.

Body and Fluff: Male: Rich red. Female: Red.

Legs and Toes: Lower thighs, rich red; shanks and toes, rich yellow tinged with reddish horn. In the male, a line of red pigment down the sides of shanks, extending to tip of toes, is desirable.

Plumage: Male: General surface, rich, brilliant red, except where black is specified; not so dark as to appear brown or chocolate nor so light as to appear orange, free from shafting or mealy appearance; the less contrast there is between wing-bows, back, hackle, and breast the better. A harmonious blending in all sections is desired. The specimen should be so brilliant in color as to have a glossed appearance. Female: General surface color, rich, even red, except where black is specified, not so dark as to appear brown or chocolate nor so light as to appear chestnut, free from shafting or mealy appearance.

Under-color of all sections: Red.

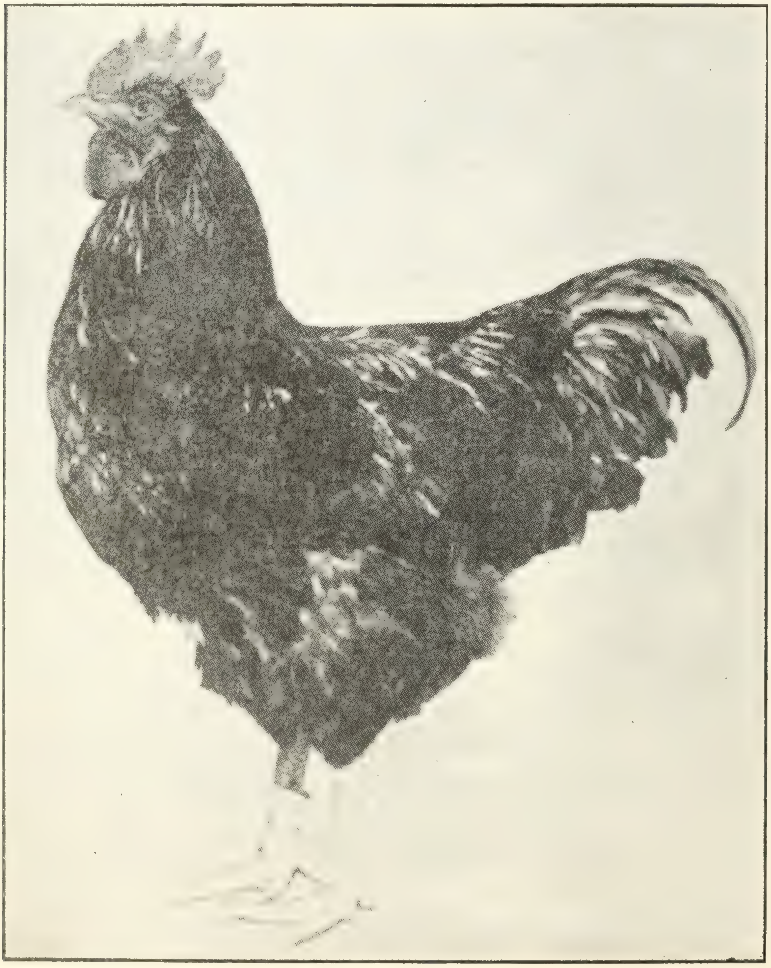


Figure 100, Rhode Island Red Male

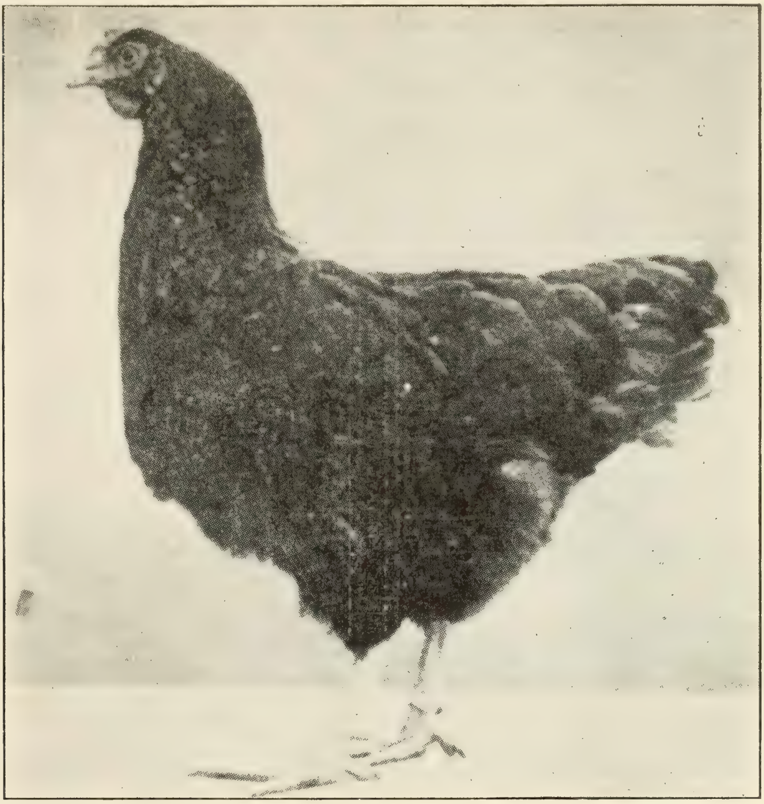


Figure 101, Rhode Island Red Female

4. Leghorns

The original breed came from Italy, but its many sub-varieties originated or were developed in England, Denmark or America. The different varieties of Leghorns are as follows: Single-Comb Browns, White and Blacks, Rose-Comb Browns and Whites, Single-Comb Buffs, Single-Comb Columbians, and Reds and Black-Tailed Reds.

Detail Characteristics of Male and Female:

Comb: Male: Single, fine in texture, of medium size, straight and upright, firm and even on head, having five distinct points, deeply serrated and extending well over back of head with no tendency to follow shape of neck; smooth, free from twists, folds or excrescences. Female. Single, medium in size: deeply serrated, having five distinct points, the front portion of the comb and the first point to stand erect and the remainder of comb drooping gradually to one side; fine in texture; free from folds or wrinkles.

The Rose comb of the male and female is very similar; of medium size, square in front, firm and even on head, tapering evenly from front to rear and terminating in a well-developed spike which extends horizontally well back of head; flat, free from hollow center and covered with small, rounded points.

Beak: Medium in length, strong, nicely curved.

Head: Moderate in length, fairly deep, inclined to be flat on top rather than round; face clean-cut, skin fine in texture, free from wrinkles.

Eyes: Rather large, full, prominent.

Wattles: Male: Moderately long, uniform, well-rounded, smooth, fine in texture, free from folds or wrinkles. Female: Of moderate size, uniform, free from folds or wrinkles, fine in texture, smooth, well-rounded.

Ear-Lobes: Male: Oval in shape but rather broad, smooth, of moderate size, fitting closely to head. Female: Of moderate size, oval in shape, smooth, thin, free from folds or wrinkles, fitting closely to head.

Neck: Male: Moderately long, nicely arched, hackle abundant, flowing well over shoulders. Female: Moderately long, gracefully arched, tapering to head.

Wings: Large, well-folded and carried without dropping; primaries and secondaries, broad, and overlapping in natural order when wing is folded.

Back: Male, Rather long, moderately broad its entire length, slightly rounded at shoulders, slightly sloping downward from shoulders to center of back, then rising in a gradually increasing concave sweep to tail. Saddle feathers long, of good width, abundant, filling well in front of tail. Female: Rather long, moderately broad its entire length, slightly rounded, with a slight slope down from shoulders to center of back, and rising from center with a concave sweep to tail, feathers of sufficient length to carry well-up to tail.

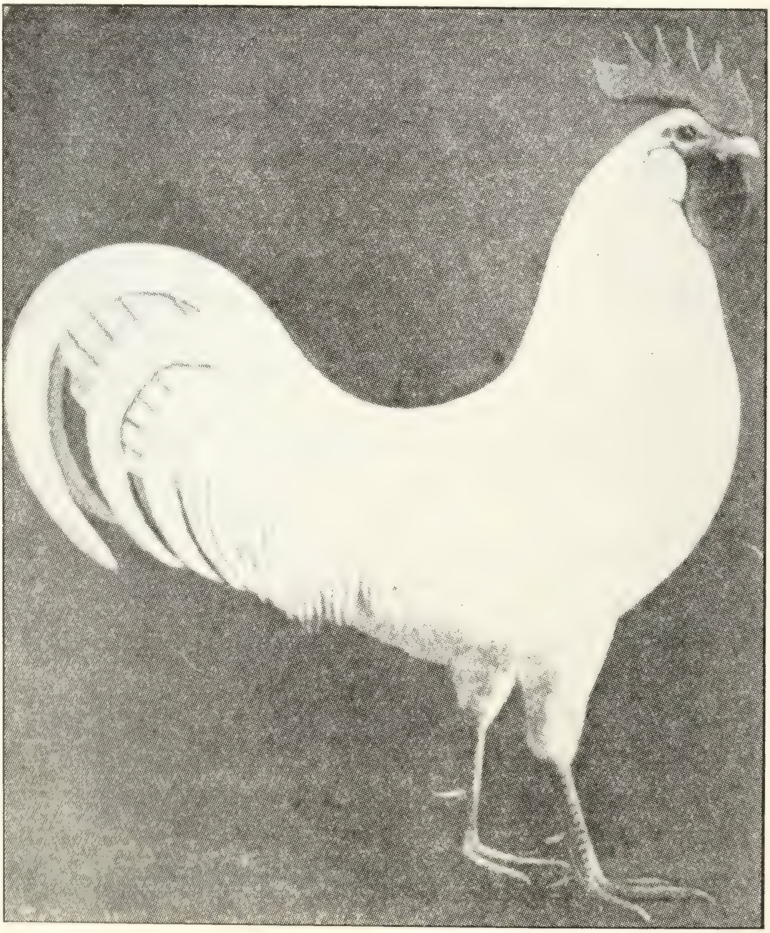


Figure 102, White Leghorn Male

Tail: Male: Large, well-spread; main-tail feathers, broad and overlapping carried at an angle of forty degrees above the horizontal; sickle feathers of good width, well curved; lesser sickles and tail-coverts, long, of good width, nicely curved and abundant. Female: Long, full, well-spread, feathers of good width, carried at an angle of thirty-five degrees above the horizontal; main tail feathers broad and overlapping; coverts, broad and abundant, extending well onto main tail.

Breast: Full, well rounded, carried well forward.

Body and Fluff: Body, moderately long, rather deep, (showing good heart and body girth in the male); carried horizontal but sloping very slightly from front to rear; fluff, short. Under line to conform generally to top line.

Legs and Toes: Legs, set well apart, straight when viewed from front; lower thighs and shanks, moderately long; toes, medium length, straight, well-spread.

White Leghorns

Disqualifications: Shanks other than yellow.

Color of Male and Female:

Comb, face, and wattles: Bright red

Beak: Yellow

Eyes: Reddish bay

Ear-lobes: Enamel white

Shanks and Toes: Yellow

Plumage: Web, fluff, and quills of feathers, in all sections, pure white.

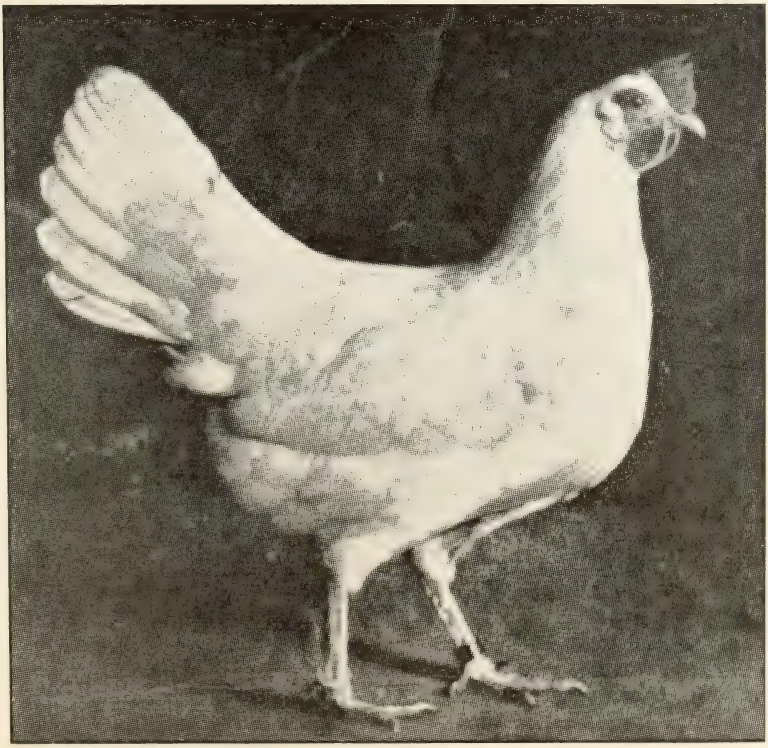


Figure 103, White Leghorn Female

PART V
CROP JUDGING

The Crop Judging contest as set-up at the present time includes cotton, corn, sweet potatoes, Irish potatoes and seed identification. In this section an attempt is made to point out those points that should be considered in judging the crops mentioned above.

COTTON JUDGING

Cotton is one of the major sources of farm income in Mississippi, and individual producers possibly know less about the classing of this crop for market than any other produced.

There are about 2 million farms in this country that produce cotton, and in any given year great variation is found in the quality of this production. Variations may occur in the quality of cotton grown on a single farm. Soils, rainfall, temperature, varieties planted, tillage methods, and harvesting and ginning methods vary. To such variations may be attributed the many differences in the quality of the cotton crop as it comes to market.

In the manufacture of cotton, uniformity of quality in the raw material is essential and since manufacturers must have cotton that is more or less uniform in respect to grade, staple length, and character, it is necessary to accumulate cotton of the several grades and staple lengths.

Cotton is classified mainly on grade and staple. In classifying for grade, the sense of sight is principally used; for staple and character, sight and touch are used in combination.

Factors of Grade

Grade of cotton, as the term is most widely understood, include three factors—color, foreign matter, and ginning preparation.

Color may be described in terms of three attributes—hue, brilliance, and chroma. Hue may be most simply defined as the name of a color, as for example yellow, red, blue; brilliance, as the lightness or darkness of a color; and chroma, as the intensity, strength or degree of color. In its application to the color of cotton the term "chroma" refers to the degree of yellowness. The darker gray cot-

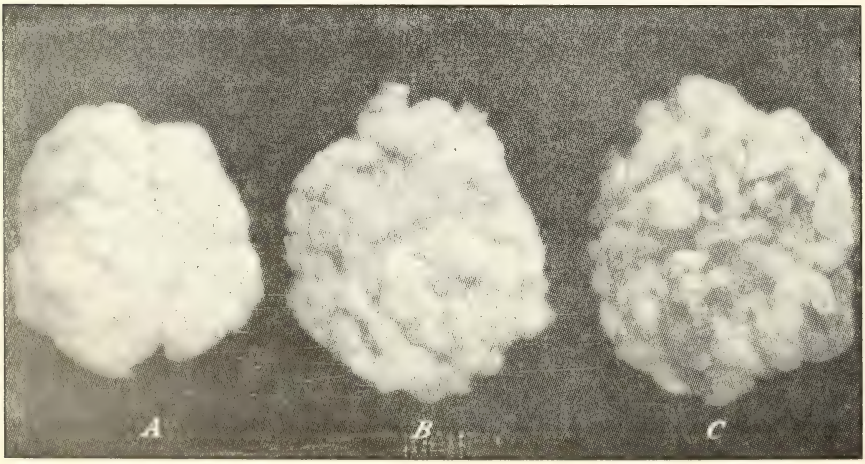


Figure 104, Differences in color of cotton picked from the same field; A, early; B, midseason; C, late. The cotton was ready to pick in September. The samples shown were picked during that month, mid-December, and early in March.

tons possess little chroma; the yellow stained, a great deal more. Differences in brilliance and chroma are the only important color differences in cotton classification, since hue varies little in upland cotton.

The effect of weather on color is very great. In the early part of the season cotton is generally of high grade: that is to say, it is bright in color and does not carry a great amount of leaf. Cotton from bolls that open after frost may be tinged or stained a yellow color. When such bolls are picked and are ginned with other bolls that have opened normally before frost, spotted cotton results. Spots are also caused by insect injury, and in localities of red soil by the inclusion of bolls that have fallen to the ground and become stained by the soil. Open cotton that is left in the field exposed to the weather becomes darker and dull in color and therefore lower in grade, as illustrated in figure 104. When cotton from tinged or stained bolls is mixed with that from bolls that have been dulled by exposure, the resulting mixture has a mottled color.

Foreign Matter

Foreign matter includes dried and broken plant foliage of various kinds, motes, seed-coat fragments, and sometimes sand and dust. Leaf may be divided into two general groups, (1) large leaf and (2) "pin" or "pepper" leaf. Large leaf is generally less objectionable than pin or pepper leaf, since larger particles are more easily removed in the spinning process and are less likely to appear in the yarn. Many of the leaf particles are removed in the picker room of the mill, and most of those that remain are removed by the carding process. Stems and hulls, like large leaf, are easily separated from the lint and in the manufacturing process never get further than the cards; but shale, the silverlike lining of the carpel or burr which before the opening of the boll serves to separate the locks, is highly objectionable and difficult to remove from the lint. Motes, which are immature and undeveloped seeds, are also objectionable. They vary considerably in size. Some are exceedingly small but others are nearly as large as mature seeds. These motes sometimes have a number of long fibers attached that usually are thin-walled. Some of the motes are crushed during ginning, and the fragments of various sizes that result are scattered through the lint, as illustrated in figure 105.

Fragments of mature seed coats are also found in the lint. These fragments result mainly from two causes: (1) The cutting of the seed by the teeth of the gin saw, and (2) the pulling away of the blunt end of the seed during ginning. The pulling away of this large fragment is usually accompanied by separation from it of smaller particles of seed coat with their attached fibers. These smaller particles may be very neplike in appearance. They also occur in very small numbers other neplike structures such as (1) knot formed by fibers becoming entangled around bits of foreign matter or small particles of seed coat, (2) small fragments from the brittle, glistening, compressed sheets of fibers occasionally found on seeds or motes, and (3) small yellowish fragments from dried diseased areas which frequently occur on the seeds.

If sand and dust are found in quantities exceeding a trace, they constitute what is known as a special condition. Sand in a sample may be detected by shaking the sample gently over a piece of clean paper. Dust is not so easily detected. Its presence is indicated by a dull, unnatural color in the cotton and can be detected by manipulating the sample somewhat as a bellows, that is, by clasping it between the hands which are then pulled gently away from each other, but not enough to separate the sample, and then pushed together, thus forcing air through the sample. As the air is forced out it carries with it some of the dust, which is visible in the surrounding air.

Foreign matter varies in quantity through each of the grades, increasing by progressively lengthening steps from the high grades, in which there is little leaf to the lower grades, in which the proportion is comparatively large. The proportion of waste varies inversely with that of the spinnable lint, and therefore the grades with the highest spinning qualities, other conditions being equal, are those in which there is the least proportion of leaf and other foreign matter.

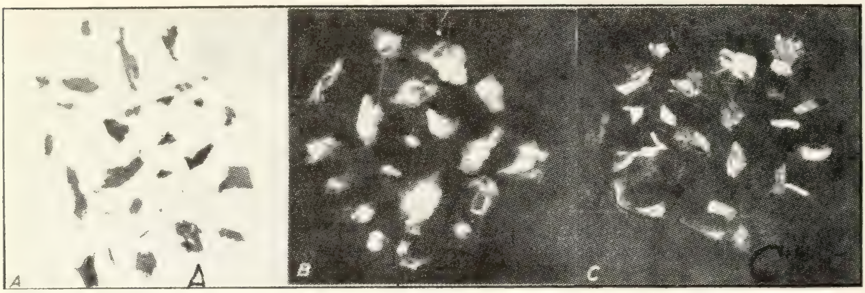


Figure 105, A, Leaf; B, Motes; C, Shale

Preparation

Preparation is a term used to describe the degree of smoothness with which the lint is ginned, and the relative nappiness or neppiness of the ginned lint.

The spinning utility of cotton depends to some extent upon its preparation. Generally, smoothly prepared cotton contains less waste and produces a smoother and more uniform yarn than roughly prepared cotton. It is generally difficult, however, to gin long-staple cottons so that the ginned lint will have as smooth and even an appearance as the shorter staples.

Neps, in contrast to naps are the small tangled knots of fibers that are visible as dots or specks when a thin web of fibers is held to the light or against a dark background. Neps in lint are very undesirable for, if not removed, they will appear as knots in the yarn and fabrics. The removal of neps from the lint is difficult, costly, and frequently impossible to accomplish. The longer and therefore finer cottons tend to be more "neppy" than the shorter, coarser cottons. Lints possessing a high percentage of thin-walled immature fibers are especially likely to be neppy.

The term "nappy" describes a lint that is rough and lumpy, and the term "nap" is applied to the definitely large clumps or matted masses of fibers that contribute to the rough appearance of ginned cotton. Their formation is influenced to a large extent by the condition of the seed cotton at the time of ginning, for cotton that is ginned green or wet tends to be nappy. In ginning, a very tight seed roll tends to result in the production of nappy lint and the breaking of the fiber.

As stated above the factors of grade are—color, foreign matter, and preparation. In grading it is almost impossible to set-up a standard for the above factors. The higher grades have a rather creamy yellowish color, with a small amount of foreign matter and the preparation good. Any one factor of grade being low will lower the grade of cotton. All three factors of grade must be considered together to determine grade. A sample of cotton with a high grade color may take a low grade due to the foreign matter and preparation. The individual classer, must have in mind all three factors and grade a given sample on what a combination of all three factors of grade show.

The cotton classer of upland cotton will deal mainly with the following grades: No. 2, or Strict good middling; No. 3, or Good middling; No. 4, or strict middling; No. 5, or middling; No. 6, or strict low middling; No. 7, or low middling; No. 8, or strict good ordinary; and No. 9, or good ordinary. The lower the

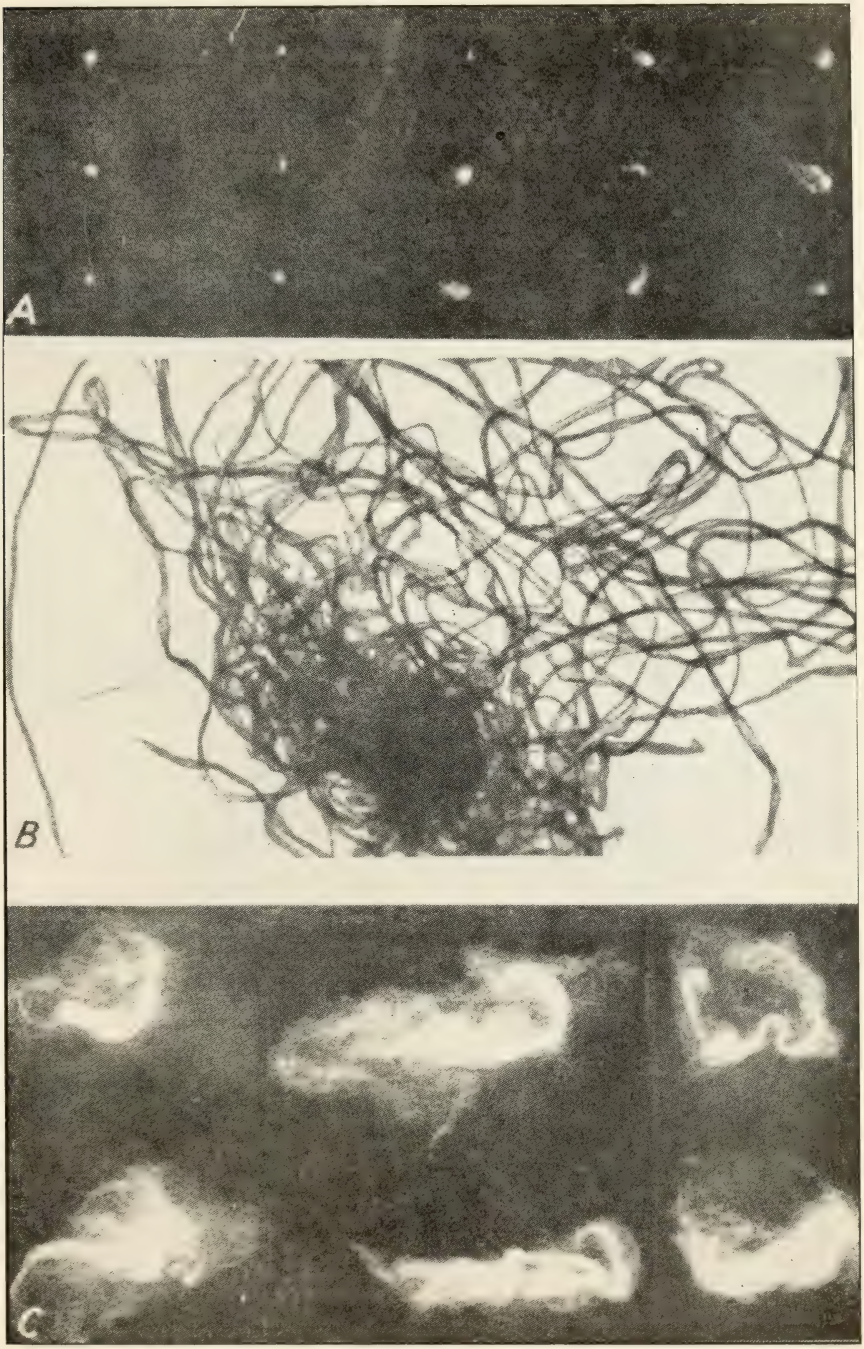


Figure 106, A, Neps; B, Neps, enlarged about 70 times; C, Naps.

number the higher the grade. Government Standards of these grades may be secured to make comparisons of samples to determine grade, and to get in mind how the different grades should look.

Factors of Staple and Standards for Staple

Staple is one of the most important factors of quality because, other factors being equal, longer staples are required in spinning the finer yarns, and in yarns of a given fineness, longer staple cottons ordinarily produce greater strength than do shorter staples.

There may be considerable variation in the length of fibers in a sample of cotton. When fibers from a sample of cotton described as being 1 5/36 inches in staple length are arrayed they have been found to range from less than 1/8 of an inch up to 1 5/8 inches in length, figure 107.

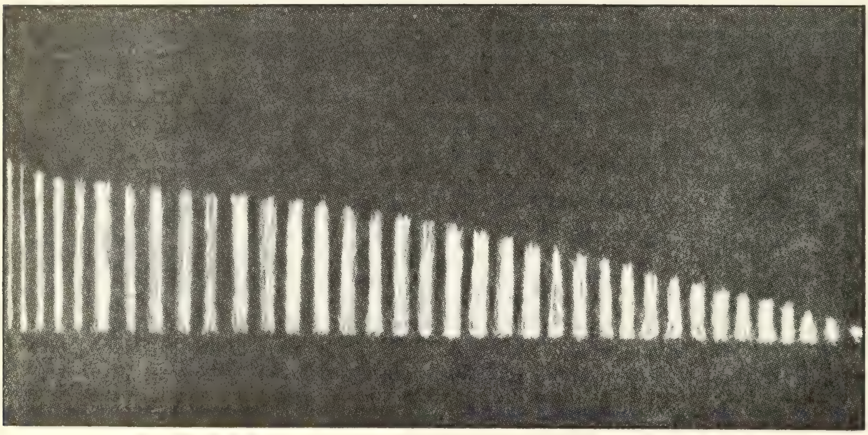


Figure 107, An array of the fibers found in a sample of cotton called 1 5/32 inches in staple. The fibers range in length from less than one-eighth inch up to 1 5/8 inches.

In determining the staple length of the sample fibers are rejected in pulling. The smooth, curved line in figure 108 represents the fibers in the sample from which the pull was made, and the broken curve line is diagram of the fibers in the pull itself. From this diagram it is easy to see which fibers were rejected and which were retained during the process of pulling for stapling. It will be observed that some of the long and some of the short fibers were disposed of but that some of both were retained.

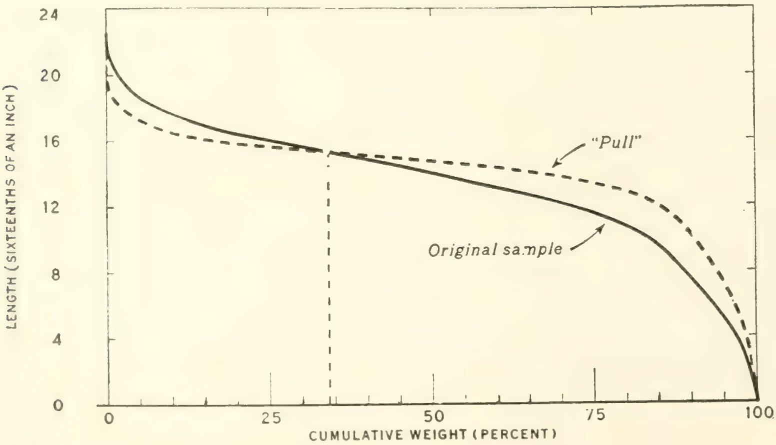


Figure 108, Diagram of fiber arrays made from a classer's pull and from a sample of the bale from which the pull was made, indicating what part of the fiber the classer discarded in making his pull.

The Department of Agriculture, Washington, establishes the staple types for each length. There were originally nine standard lengths for staple set-up in October 1918. Since that time the original standards have been amended under the authority of the Cotton Futures Act and the Cotton Standards Act by authorizing the issuance of staple types for additional lengths. Such types are available in 1938 for American upland cotton of the lengths 3/4, 13/16, 7/8, 29/32, 15/16, 31/32, 1, 1 1/32, 1 1/16, 1 3/32, 1 1/8, 1 5/32, 1 3/16, 1 7/32, 1 1/4, 1 9/32, 1 5/16, 1 11/32, 1 3/8 and 1 1/2 inches respectively.

The staple types as listed above may be obtained from the Department of Agriculture in Washington.

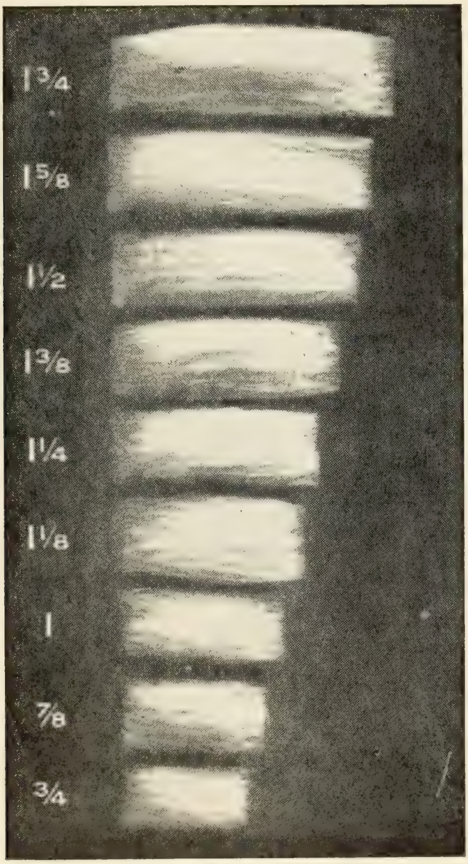


Figure 109, Staple lengths. Pulls from types representing the official standards for nine selected lengths of staple.

Method of Stapling

Regulations concerning stapling: The classification of cotton according to length of staple should be considered in conjunction with provisions of the regulations of the Secretary of Agriculture under both the Cotton Futures Act and the Cotton Standards Act which state: (1) That if the sample drawn from one portion of a bale is shorter in length than one drawn from another portion of the bale, except as otherwise provided in the regulations, the classification of the bale shall be that of the sample showing the shorter length; and (2) that if cotton be reduced in value by reason of the presence of extraneous matter of any character or irregularities or defects below its apparent length of staple according to the official cotton standards of the United States, the length of staple from which it is so reduced and that to which it is so reduced, and the quality or condition which so reduces its value, shall be determined and stated. In addition, there is the provision in the regulations under the Cotton Futures Act that all cotton whether tenderable or untenderable shall be classified on the basis of the official cotton standards of the United States in effect at the time of such classification, and that it shall be deemed a sufficient compliance for the purpose of that act if cotton of tenderable length of staples shall be classified in sixteenths of an inch. These regulations as well as those regarding the conditions of handling and classing the cotton must be observed.

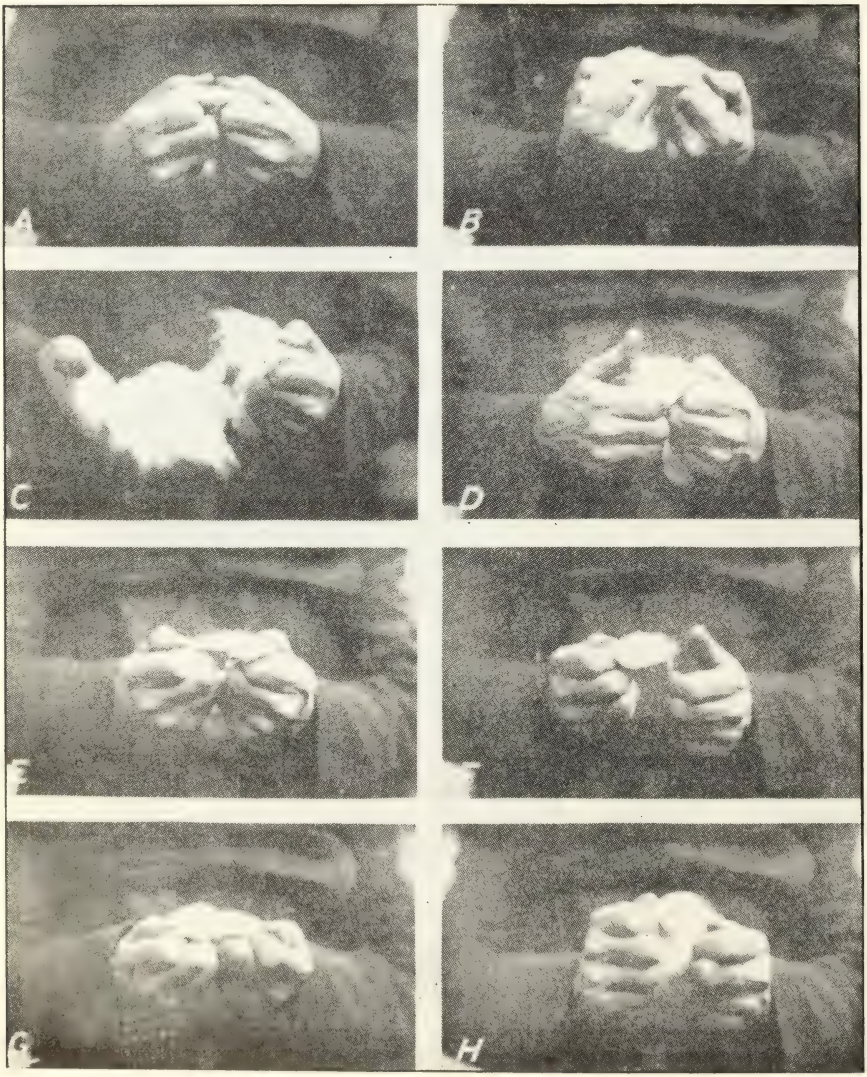


Figure 110, Method of pulling staple (See text for instructions).

Typical portion selected by stapling. In the practical application of the standards, the selection or determination of a typical portion of the fibers of any cotton is made by a process of manual stapling. The method of stapling recommended by the Department of Agriculture is given below:

Instructions for pulling staple. Grasp in the two hands a tuft of cotton of a size convenient for the purpose (about one-fourth of an ounce), holding it firmly between the thumb and forefinger of each hand, with the thumbs placed together, the fingers being turned in toward the palms of the hands, and the middle joints of the second, third, and fourth fingers of each hand touching the corresponding joints of the fingers of the other hand, so as to give a good leverage for breaking the cotton (figure 110-A).

Pull the cotton slowly with about the same leverage of each hand on the joints of the fingers, separating the tuft of cotton into two parts (figure 110-B).

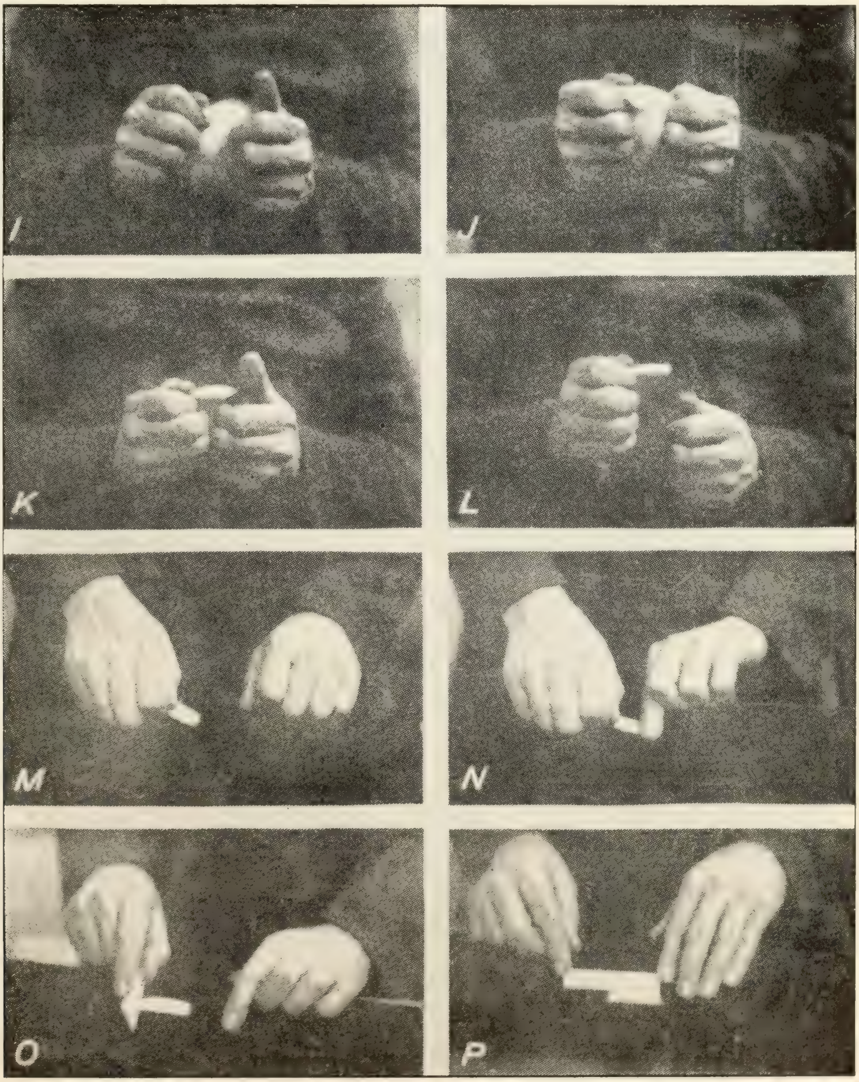


Figure 111, Method of pulling staples (continued).

Discard the part remaining in the right hand (figure 110-C).

Grasp with the thumb and forefinger of the right hand the end of the tuft of the cotton retained in the left hand. The point of pressure on the cotton in the left hand is just below the joint of the thumb and at the nail joint of the forefinger (figure 110-D).

With the right hand draw layer of fibers from the cotton held in the left hand (figure 110-E). Retain in the right hand the layer so drawn (figure 110-F). Repeat this operation four or five times, placing each successive layer directly over the fibers previously drawn, using care to see that the ends of all the layers are even with each other between the thumb and forefinger of the right hand (figure 110-G and 110-H, figure 111-I and 111-J).

After discarding the cotton in the left hand, hold the fibers thus obtained between the thumb and forefinger of the right hand and smooth them with the thumb and forefinger of the left hand (figure 111-K and 111-L).

Place these fibers on a flat, horizontal surface with a black background, preferably black velvet (figure 111-M and 111-N).

Block off the ends of the fibers with a cotton-stapling rule, so as to indicate the length of the bulk of the fibers, and measure the distance between the blocked-off ends (figure 111-O and 111-P).

If this method is correctly and consistently followed, the length obtained should agree with that obtained by comparisons with pulls from the official staple types.

Reference: United States Department of Agriculture Miscellaneous Publication 310, “The Classification of Cotton”, May, 1938.

CORN JUDGING

Type

Corn type is a direct outgrowth of standards that have been created for varieties. It deals with variety characteristics, especially those of a more constant nature, such as color, shape and size of grain, color of cob, and indentation. To establish a definite type within any variety is difficult because corn is materially affected by the soil and climatic factors. However, within certain zones of latitude, (a state, or a major portion of a state) definite types can be established to which the majority of ears will largely conform. While type involves all the score card points, some are of far greater significance than others.

It is only through a thorough knowledge of type features that one will ever become able to recognize varieties and standardized types within the varieties. Unless samples of corn are exhibited in a variety class, type is not a feature to which judges pay attention. For example, samples of corn exhibited merely as either yellow or white corn are judged upon features other than type. Type, then, is a study of the characteristics peculiar to the variety.

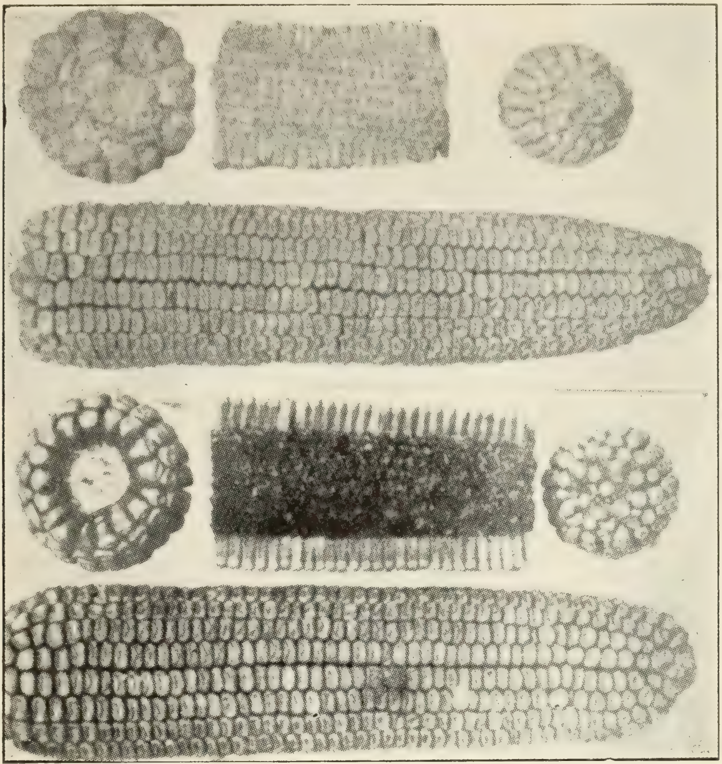


Figure 112, Top ears, type of corn to avoid. Lower ears, type of corn to select.

Placing Card for Corn Judging

Contestant's No.__________Team No.__________Class__________

POINTS FOR COMPARISON	First	Second	Third	Fourth	Score
Trueness to type and variety, including purity of kernel and cob					
Soundness and maturity—freedom of disease character of germ					
Uniformity of ears, size and shape					
Uniformity of kernel—shape, size, color, indentation, etc.					
Fancy points, straight rows, covered tips, butts, etc.					

Average of above scores__________

	First	Second	Third	Fourth	Score
FINAL PLACING SCORE					

SCORE__________

Shape and Size of Ears

Within any variety of corn numerous shapes of ears will be noted. The cylindrical ear with a slight, gradual taper toward the tip is most desirable. As a rule, sharply tapering ears have less uniform kernels not regularly arranged and frequently they have a lower percentage of shelled corn. Furthermore, they do not make as good an appearing sample when exhibited for show corn. In addition to being cylindrical, an ear should be straight and have straight rows of kernels.

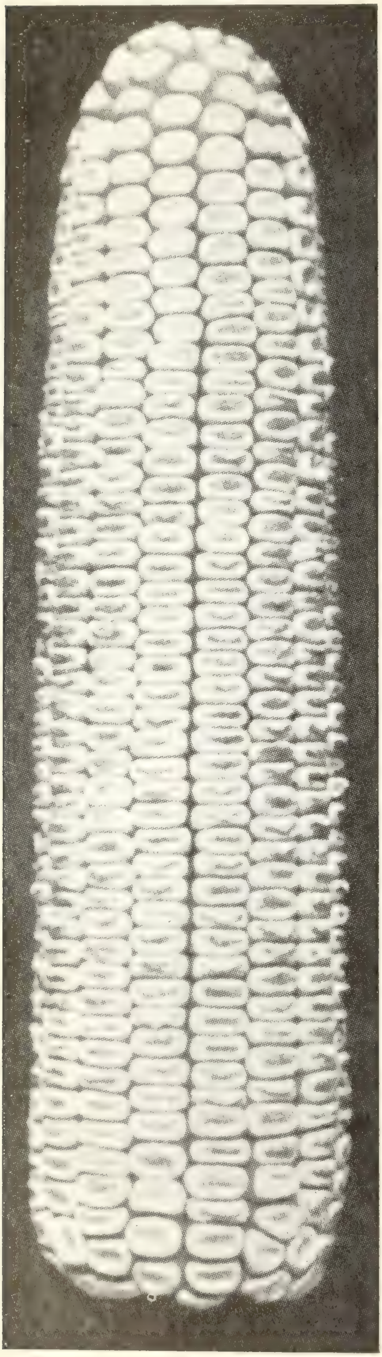


Figure 113. An ear that is ideal in shape and proportions.

Each ear should be well proportioned in size, consideration being given to both length and circumference. In well-proportioned ears of dent corn. the circumference should measure about three-fourths of the length. Long, slender ears are objectionable because they generally have shallow kernels and poorly filled tips and butts. On the other hand, short, thick ears are undesirable, not only from their lack of length, but also because they are liable to possess an oversized cob, usually meaning a low shelling percentage. Most Southern varieties are prolific, or semi-prolific, and ears are usually smaller than single-ear varieties. In judging corn, ear size is important only as it conforms to varietal characteristics.

Color of the Grain

When the corn is grown and harvested under normal conditions, color of the grain is one of the more constant characteristics. Although there are variations in color within any variety. Good type will not tolerate colors other than color specified for each variety. In addition, ears should be sound and uniform in color. Ears badly discolored are usually diseased and have poor germinating qualities.

Since corn is a plant that naturally cross fertilizes, one should be careful to study the ears closely for mixtures in color which are liable to be present. Mixed seed are not typical of any variety and ears having them are not desirable for planting.

Color of Cob

Cob color should be true to varietal standards. Usually white varieties have glistening white cobs, notable exceptions to this, however, are Jarvis, Paymaster, and Whatley, while yellow varities have red cobs. In addition, the study of the cob may furnish an index to the vitality of the seed. Dark colored, moldy, sappy cobs indicate a diseased condition. All such conditions should be carefully guarded against.

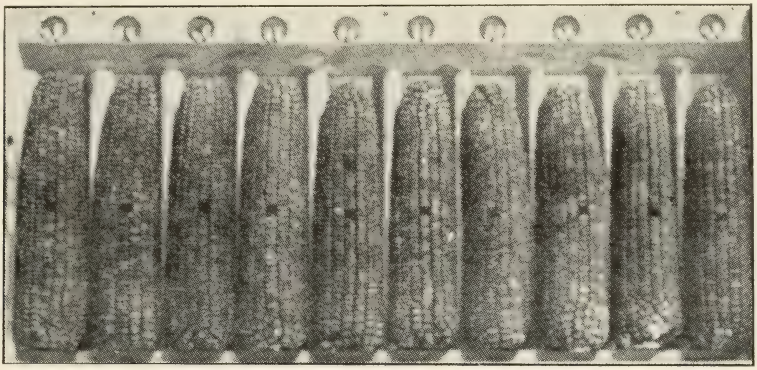


Figure 114, A sample that is ready for the judge.

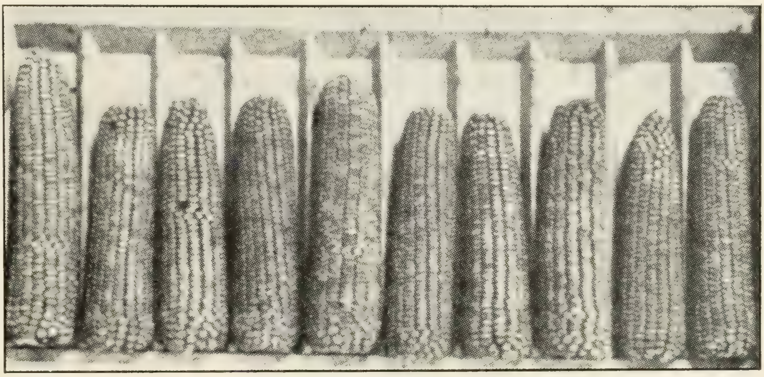


Figure 115, A sample lacking in uniformity and poorly arranged.

Market Condition

Of all the points considered in judging corn, market condition is of the greatest importance to the grower. It has to do with two principal factors—degree of maturity and soundness. Immature corn will not keep well and it quickly loses its power to grow. When immature ears are dried out, the immaturity is indicated by loose, poorly filled kernels and light weight ears. On the other hand, mature ears when curved have plump well-filled kernels that are set close together so that there is very little, if any, looseness of kernels. Good seed and show corn should be perfectly sound. Damage of any kind will discredit a sample. Judges and growers cannot be too critical in the matter of knowing what excellent market condition means. Frequently there are those who think that market condition also deals with shelling percentage and mixture. This is not the case and the two considerations should never be confused.

Tips and Butts

Well-filled and regularly formed tips and butts add materially to the appearance of an ear or a sample of corn. This is a matter more largely concerned with fanciness than with practical features. Therefore, it is not nearly as important as market condition, purity and uniformity of the sample. To select ears either for seed or for the show largely from the standpoint of good tips only is a serious mistake, though in judging a large number of well-selected exhibits, this otherwise minor point is sometimes of considerable importance. In a perfectly formed tip the rows are rarely found, but in making up show samples one should select the best he can find and still maintain other more valuable qualities in the ears. Long tapering tips are very undesirable because they usually result in a large percentage of irregular and shallow kernels. In addition, the general appearance of the ear will not be good.

The butts should also be well filled out with regular rows so as to round out nicely about the shank. In most varieties the shank attachment, indicated by the scar, should be about three-fourths the diameter of the cob. Shanks beyond this size usually mean coarse butts covered with large, irregularly shaped kernels. Both tip and butt kernels should be rejected for planting, as they will not feed uniformly through the planter plates.

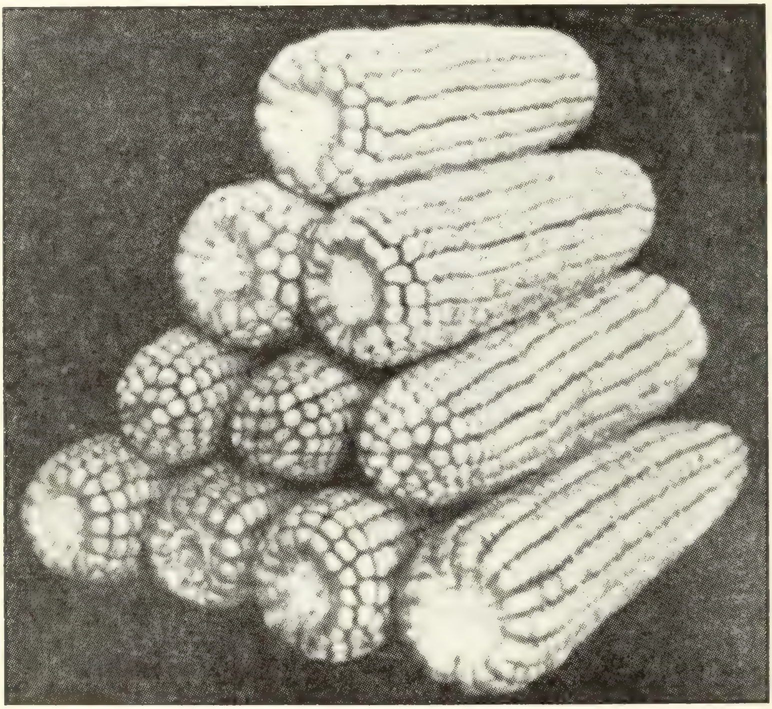


Figure 116, Ears that possess the desirable features for the variety and in addition are well tipped and butted.

Uniformity and Shape of the Kernels

Uniformity in size and shape of kernels on a single ear as well as among the ears in a sample is a highly desirable feature. It not only indicates good breeding through proper selection, but adds greatly to the general symmetry of the sample or ear. Furthermore, ears with uniform kernels when used for seed will produce a better stand of plants in the field because the planter will drop them at a more even rate. It would be difficult indeed to find ears whose kernels are exactly uniform, but great variations should be guarded against.

In dent corns the medium wedge-shaped kernel is best because it occupies the kernel space on the cob most completely. Square and rounded wedge-shaped kernels permit wide space between the rows. In general, the crown of the kernel should be from two to three times as wide as it is thick. This will give it an oblong appearance.

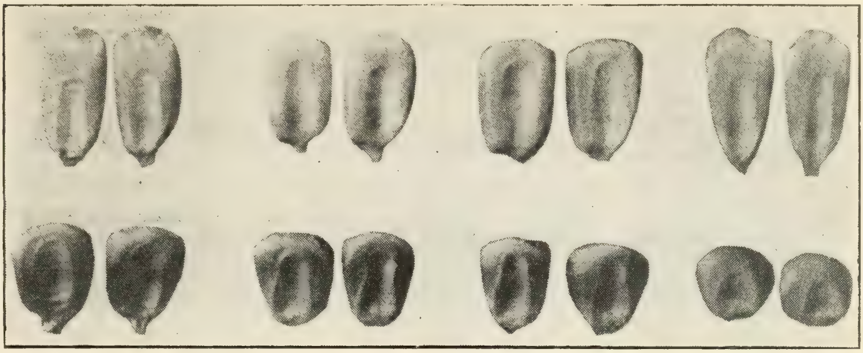


Figure 117. To judge kernels remove two from each ear two-thirds of the way from butt to tip. Place each pair near the ear from which they were taken and compare with the ideal. The top row illustrates the best while those in the bottom row are too short and thick for dent corn. The long wedge shaped kernels shown at the right of the top row and the two pair in the center of the row are desirable.

Length of the Ear

Although the ears in any variety of corn will show considerable variation in length, still when grown under normal climatic soil conditions, the majority of ears will conform reasonably well to the variety standard of length. This is especially true of pure varieties. Upon this basis standard lengths for each of the leading varieties have been established. Long ears are usually objectionable because they are inclined to have poorly filled tips, irregular butts and shallow kernels. On the other hand, short, stubby ears are inclined to be coarse in every respect.

Circumference of the Ear

In a well-proportioned ear the circumference measured at about one-third the distance from the butt will be from three-fourths to four-fifths of the length measurement. A little experience in handling ears of corn will soon make the beginner capable of estimating these measurements accurately. However, he should begin by making the actual measurements.

Space between the Kernels

Straight rows are desirable because the spaces or furrows between them are usually very narrow. Poorly shaped and shallow kernels usually accompany wide furrows. The furrow or groove should not extend to any great depth. It should simply mark the dividing line between the rows. Wide and deep-furrowed ears are liable to be light in weight. Spaces between the kernels at their tips are also very objectionable.

Percentage of Shelled Corn

Shelling percentage refers to the amount of shelled corn obtained from any given weight of ears. While it can only be determined accurately by actually shelling the ears and making the proper calculations, one is able to recognize high- and low-shelling ears by studying them for the factors concerning shelling percentages. One hundred pounds of ear corn, slip shuck basis, of average quality will shell about 80 pounds of corn, the remainder being the weight of the cobs. Therefore, it is commonly said that corn shells an average of 80 per cent. One experienced in handling ear corn soon learns to recognize the factors concerned with a high-shelling percentage. The three most important of these undoubtedly are the following: maturity, depth of kernel, and number of rows. To these might also be added filled tips and butts, medium-sized cobs and close-furrowed rows. Good seed corn and certainly show corn should shell higher than the average.

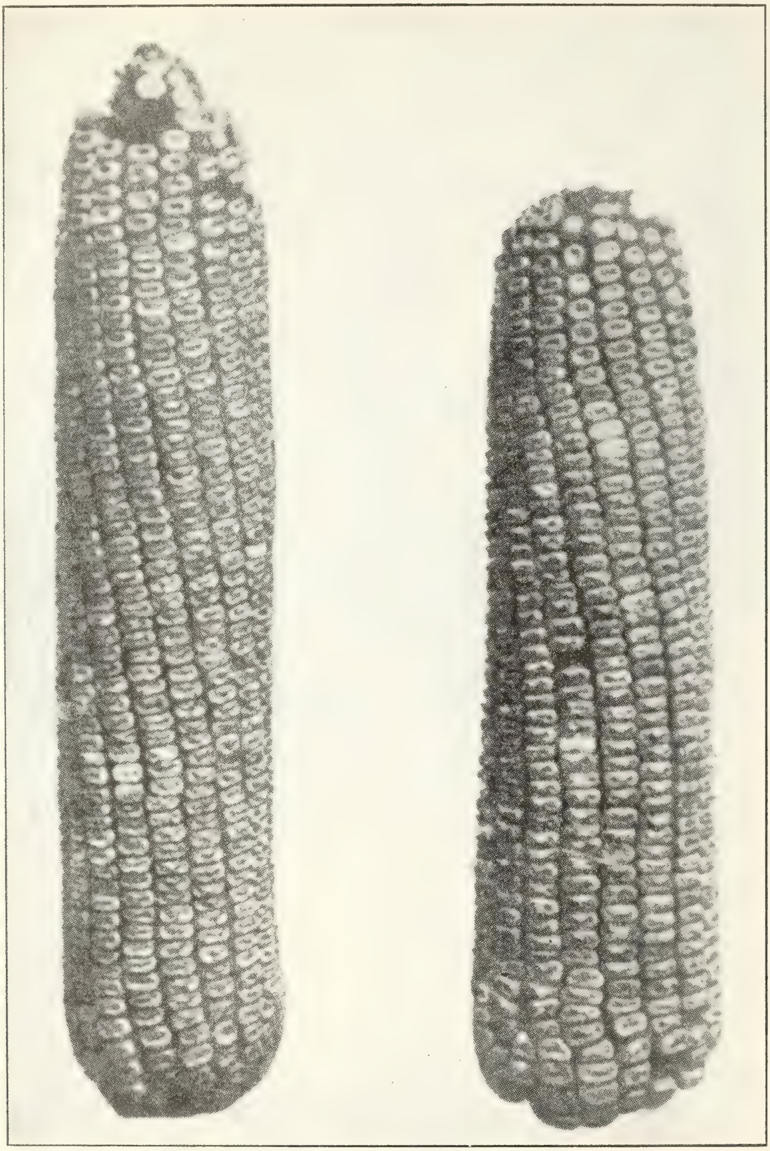


Figure 118. Ears with spiral rows should not be accepted either for seed or show purposes.

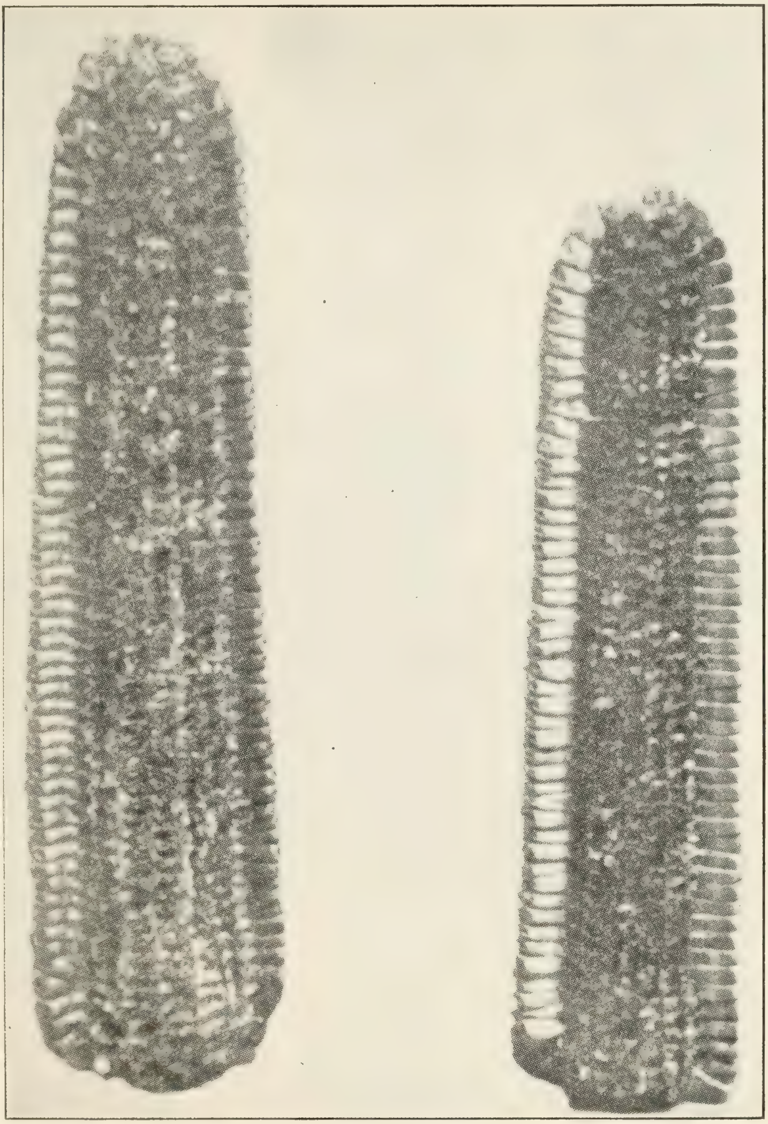


Figure 119. The ear at the left is coarse cobbed and shallow kerneled and therefore will hardly show a normal shelling percentage. The one at the right shows an opposite condition and will shell a high percentage of corn.

Corn Varieties

Cockes Prolific

Named for General Cocke of Bremo Farm in the James River Valley of Virginia and recognized before the Civil War. J. B. Allen of Port Gibson, Mississippi, made selections from it. Dr. H. B. Brown obtained seed from Mr. Allen in 1915 and did further work with it at the Mississippi Experiment Stations.

Cockes Prolific is a white variety usually producing two or more ears per stalk. Ears are a little larger than Hastings, but considerably smaller than Mosby. Ears slightly tapering, 7½ to 8½ inches in length, 1½ to 2 inches in diameter, and bear 12 to 14 rows of kernels. Kernels of medium length, broad, plump, and

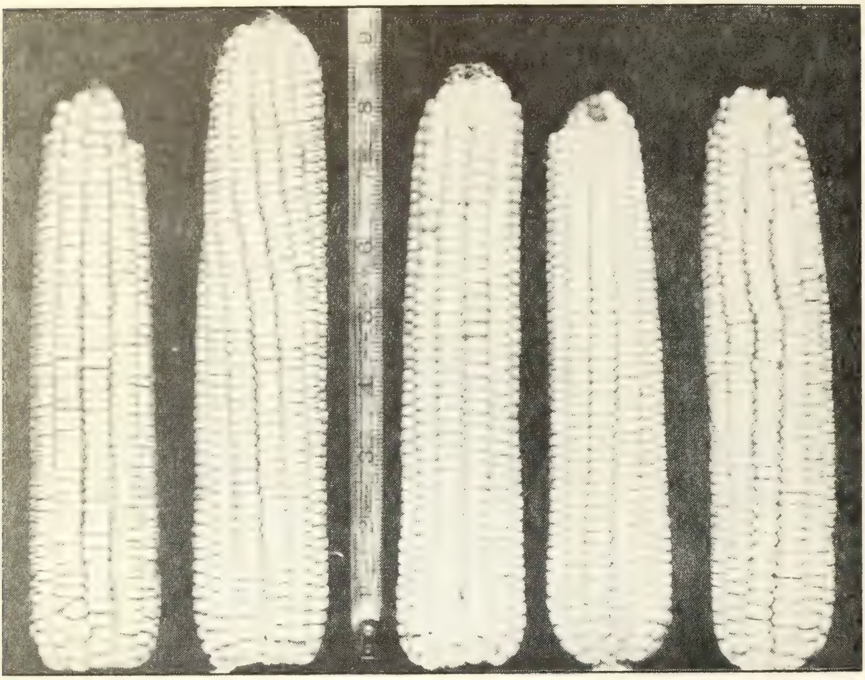


Figure 120. Cockes—A bit irregular in type, but a high producer.

grayish white in color with very slight indentations. Cob small and white. Matures in 120 to 125 days.

College 47

First produced at the Mississippi Experiment Station by the hybridization of two well known varieties, Cockes Prolific and Laguna. Like Laguna it has considerable ability to withstand adverse conditions. Ears medium to large and tapering, 8 to 9 inches in length and 2 to 2½ inches in diameter. Cob white, medium large, and bears 14 to 16 rows of kernels. Kernels are pearly white, medium length, wide, and plump with smooth creased indentation. Ear tip seldom filled well, butts flat. Matures in 120 to 125 days.

Since this is a cross between two varieties, it must be treated as a hybrid and new seed obtained each year for planting. It is a varietal cross; and therefore not a hybrid between inbred lines.

Golden Dent

A good yielding yellow variety, ears long and slightly tapering 8 to 9 inches long and 2 to 2½ inches in diameter, bears 16 rows of kernels. Kernels medium length, wide, plump, and golden yellow in color; smooth dimpled to rough creased indentation. Matures in 115 to 120 days.

Hastings

The exact origin of this corn is not known. H. G. Hastings and Company, Atlanta, Georgia, obtained seed first from a Georgian whose father had grown the crop before the Civil War. The seed having first been obtained from a covered wagon transit passing through Georgia from the Carolinas. The Hastings firm has selected, developed and grown this corn since before 1900.

Hastings is a true prolific characterized by small ears 6½ to 7½ inches in length and 1½ inches in diameter. Cob is small and white bearing 12 to 16 rows of kernels, usually two to four ears per stalk. Kernels of medium length, hard, slightly indented, and grayish white in color. Matures in 125 to 130 days.

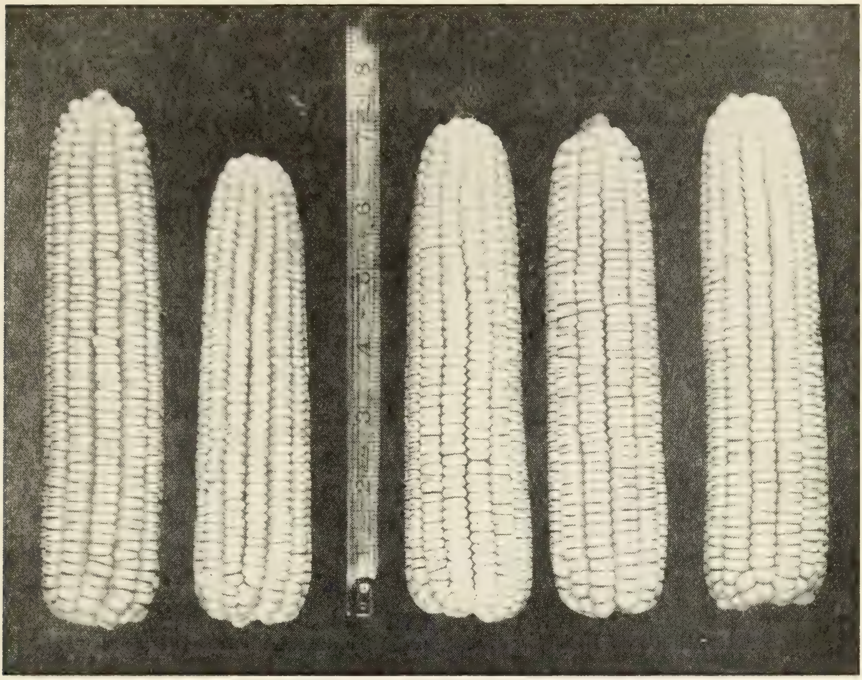


Figure 121, Hastings Prolific, high producer, small eared, widely grown.

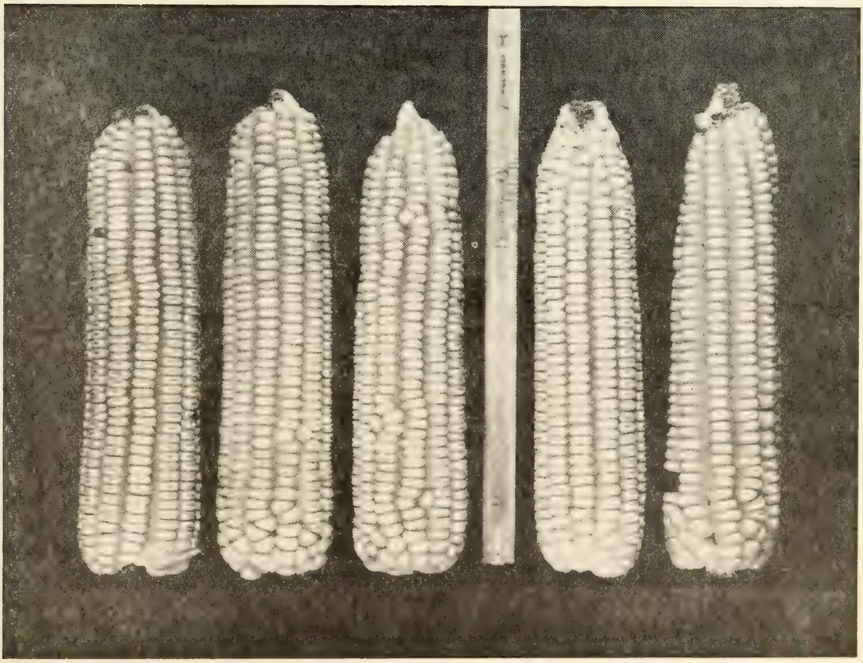


Figure 122, Jarvis, a very popular yellow corn.

Jarvis

Developed by J. M. Jarvis, Winston-Salem, North Carolina. Mr. Jarvis followed the system of field selection from stalks which produced two good ears. Other points were probably kept in mind, but the chief consideration was given to yield. Jarvis also seems to have an advantage in soil adaptability.

It is true prolific yellow variety easily distinguished by its white cob and other ear and plant characters. It has a medium low stalk, with low set ears 7 to 8 inches in length and 1½ to 2 inches in diameter. Twelve to 14 rows of kernels, slightly tapering, and golden yellow in color. Kernel of medium length, broad, full, hard, and very slightly indented. Butts flat, tips fair. Matures in 115 to 120 days.

Jellicorse

A white variety of corn developed by Reggie Jellicorse, Elmwood, Tennessee. Selections were made by Mr. Jellicorse for yield and quality of grain. The grain is of excellent quality. Ears are 6½ to 7 inches in length and approximately 2 inches in diameter. Cob white and bears 12 to 16 rows of kernels. Matures in 120 to 125 days.

Jellicorse has proven to be a high yielding variety in the northern one-third of the state, but may be questionable in the central and southern portions.

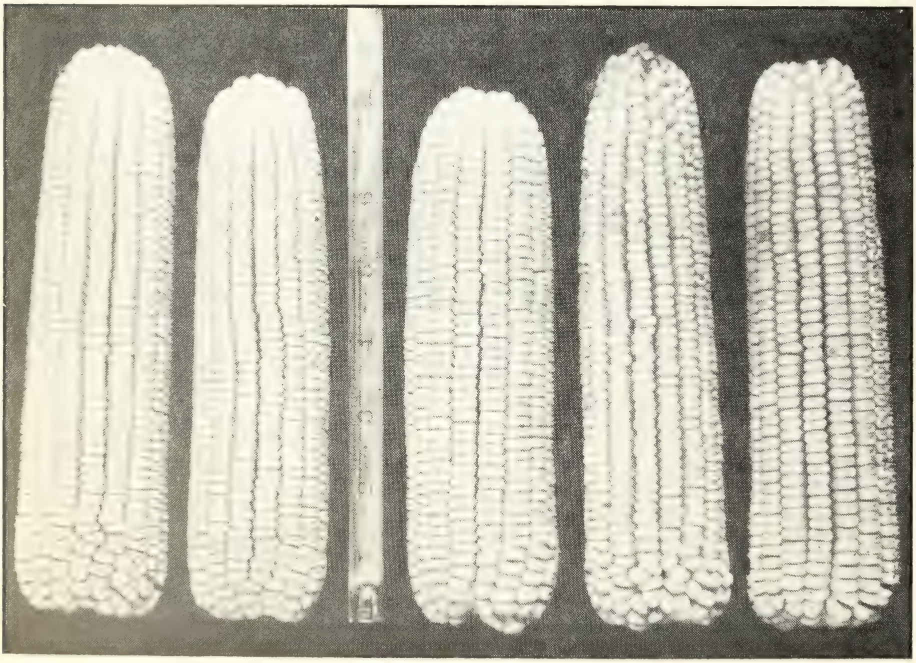


Figure 123. Johnson's Prolific, uniform in type, a medium producer.

Johnson's Prolific

Johnson's Prolific is a white variety resembling Mosby except the ears are a little shorter. Ears 6½ to 7 inches in length, 1½ to 2 inches in diameter. Cob white and bears 14 rows of kernels. Developed by J. W. Johnson, Quitman, Miss.

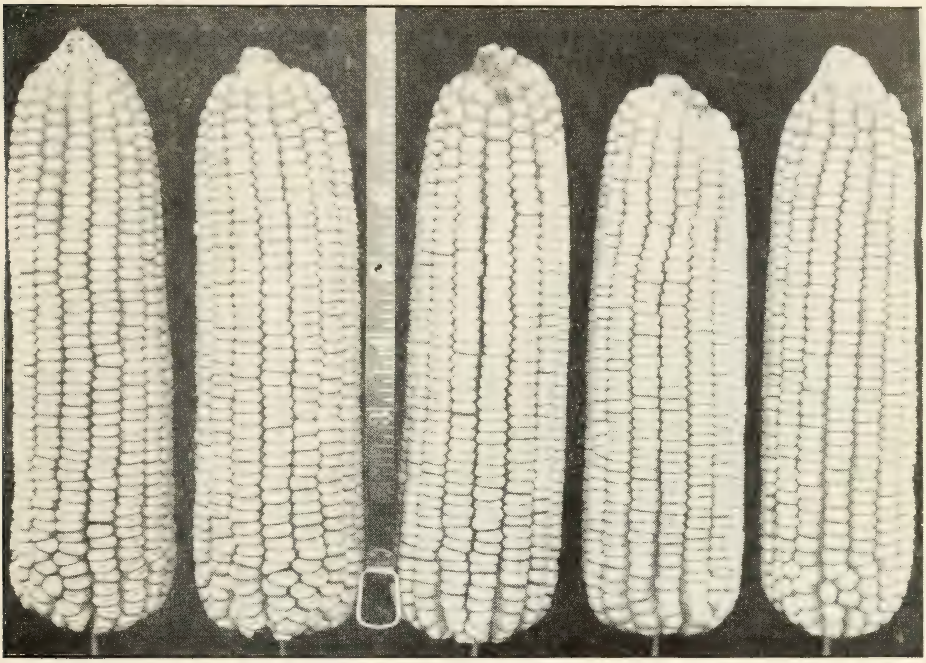


Figure 124, Laguna, an excellent corn for planting after the middle of May.

Laguna

For a number of years Laguna has been kept in a high state of production by the Mississippi Experiment Station. Apparently this is one of the best varieties known for late planting in this state. Although the time required for the maturing of Laguna is approximately the same as for Mosby and other varieties, it seems to stand the adverse weather conditions that usually occur during the latter part of the growing season, and like Mexican June will build its yield above other varieties planted under these conditions.

Laguna is a white variety with medium size stalks and medium ear height. Ears 7½ to 8½ inches in length and 2 inches in diameter. Kernels broad, medium length, and plump with a characteristic white cap. Indentation smooth creased to dimpled. Cob white, medium size, and bears 14 rows of kernels. Tips of ear seldom well filled, butts flat. Matures in 120 to 125 days.

Marchetti

A yellow dent variety developed by J. W. Marchetti, Hazlehurst, Mississippi. Relatively small ears 6½ to 7 inches long and 1½ to 2 inches in diameter, usually very irregular in length. Cob dull red and bears 14 rows of kernels. Kernels of medium length and plump with smooth to rough indentations. Matures in 115 to 120 days.

Mosby

Developed by J. K. Mosby, Lockhart, Mississippi, in the late 90's. Later strains including Delta Mosby, Woodruff's Mosby, Suttle Mosby, and others have been developed by the experiment stations and individual breeders.

Mosby is a white semi-prolific variety normally producing one large ear and a nubbin to two medium sized ears per stalk. Ears 8 to 9 inches long, slightly tapering, and approximately 2 inches in diameter. Cob is white and bears 14 rows of kernels. Kernels are of medium length, wide, wedge shape, and roughly indented. Tip of ear usually not so well filled. Matures in 120 to 125 days.

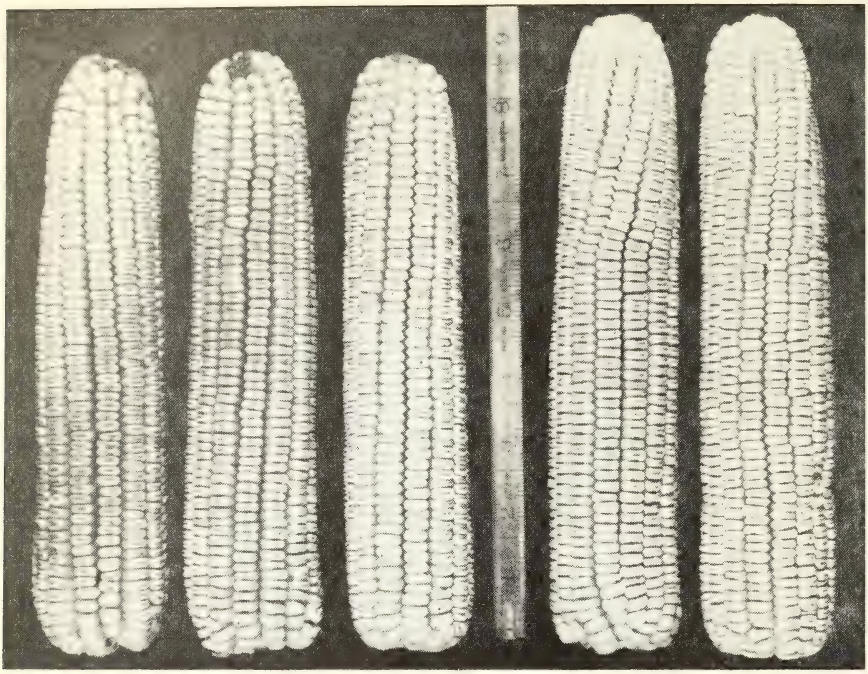


Figure 125, Mosby, a very popular general purpose corn

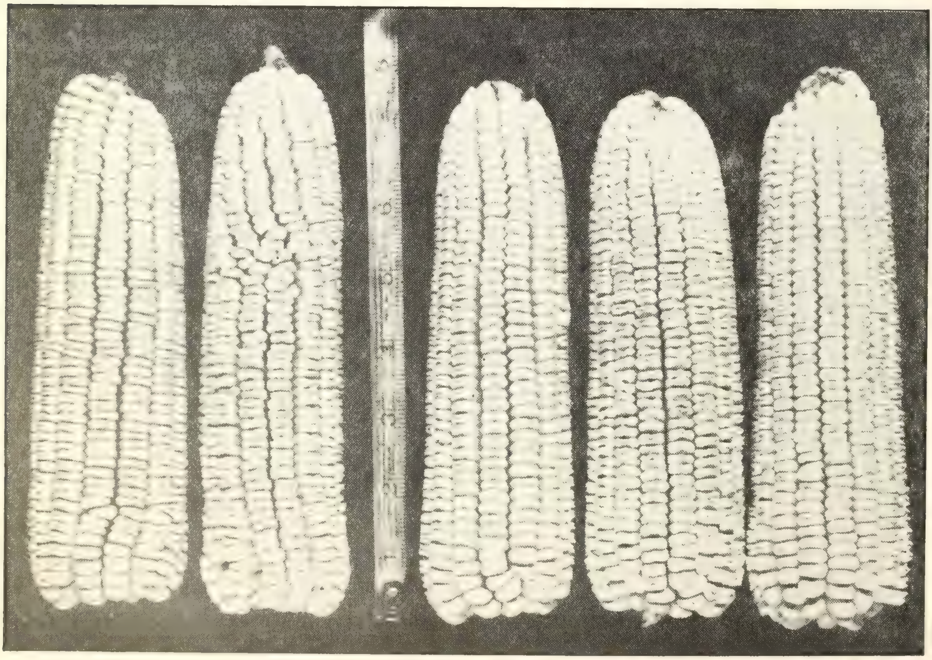


Figure 126, Paymaster, a high producing soft corn suitable for north third of State.

Neals Paymaster

Developed by W. H. Neal at Lebanon, Tennessee. Mr. Neal began some 25 years ago with a mixed variety and has persistently selected for yield and a red cob. He made his selections in the field from plants that produced two good-sized ears to the stalk.

Paymaster is a white variety with a medium sized stalk and medium ear height. Ears are 7 to 8 inches in length and 2 to 2½ inches in diameter, slightly tapering, and bear 14 to 16 rows of kernels. Grain white in color. Cob is small and light red. Matures in 115 to 120 days.

This variety is probably one of the best that can be grown in the northern one-third of the state, but like Jellicorse may be questionable in the central and southern portions.

Piggotts Red Cob

Originated and developed by B. W. Piggott and Son, Tylertown, Mississippi.

This variety is sometimes called shoe peg corn. It has long pointed kernels and a very small cob. Ears 5 to 6 inches long, 1½ to 2 inches in diameter. Cob very small, deep red, and bears 16 to 20 rows of kernels. Kernels are ivory or straw white in color, extremely long, narrow, and almost round with very rough or beaked indentation. Matures in 120 to 130 days.

Surecropper

This variety was originated and developed in Texas. The grain is creamy white and very susceptible to ear rot. Ears 7 to 8 inches in length and approximately 2 inches in diameter. Cob white and bears 14 rows of kernels. Indentation smooth to rough creased. Matures in 115 to 120 days.

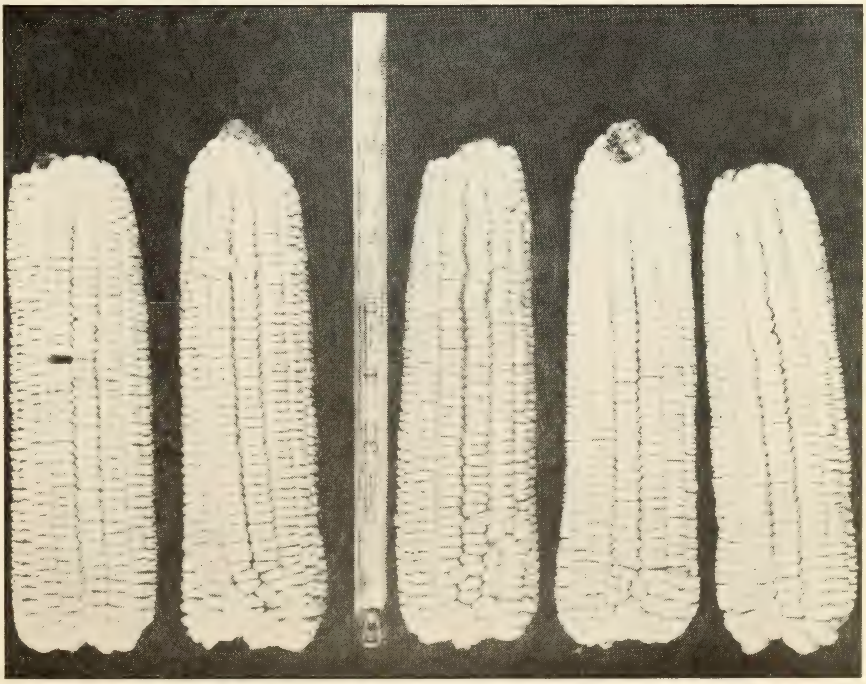


Figure 127, Whatley Prolific, high producer, small eared; not widely distributed.

Whatley Prolific

Originated and developed by Whatley Brothers, Helena, Georgia. It is a white variety with a red cob, resembling Paymaster to some degree but can be identified quite well from it. Ears 6½ to 7 inches in length and 1½ to 2 inches in diameter. Cob dull red and bears 12 to 14 rows of kernels, indentation rough to beaked, ears slightly tapering, grain pearly white. Matures in 120 to 130 days.

Reference: Mississippi Farm Research, Volume 3, Number 3, March, 1940.

SWEET POTATOES

Porto Rico

Vines medium to long, 5 to 10 feet; stems coarse, internodes short, reddish purple in color, hair especially at the nodes and on young growth; leaves shouldered, large in size, green except purple at base of blade and one veins, slightly hairy on upper surface, smooth below; petioles medium long, 5 to 8 inches, reddish purple in color, deeper at the base of the leaf blade, color extends up on veins of lower sides of leaf, color also deeper at base of petiole. Roots light rose in color, fusiform to globular and irregular in shape, smooth, flesh orange-yellow to salmon.

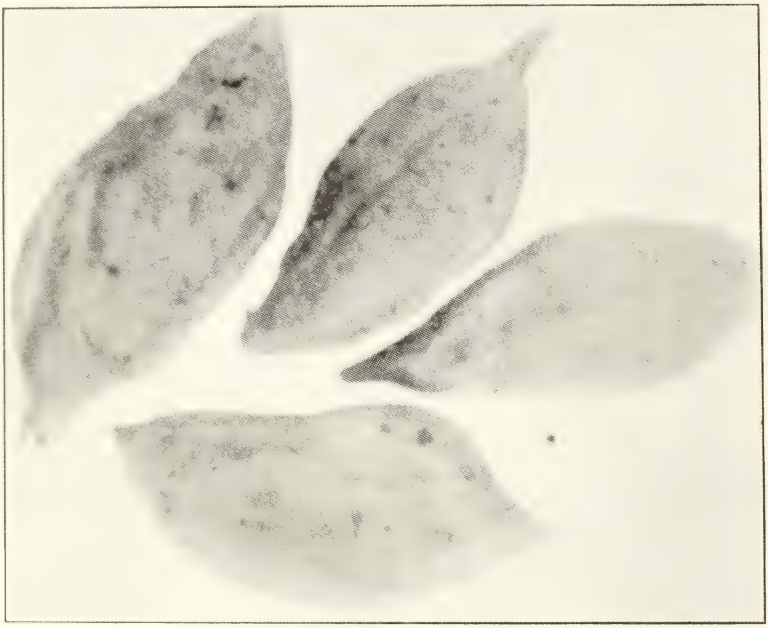


Figure 128, Porto Rico

Nancy Hall

Vines medium in length 4 to 8 feet; stems somewhat hairy, green; leaves toothed or entire with 4 to 10 marginal teeth, hairy on upper surface and slightly hairy or smooth beneath, green except a reddish purple stain at the juncture of the blade and petiole, the later slightly hairy, green except at upper end. Roots yellow tinged more or less with salmon, veined, or smooth and regular, fusiform in shape, medium to large in size; season early; of excellent quality.

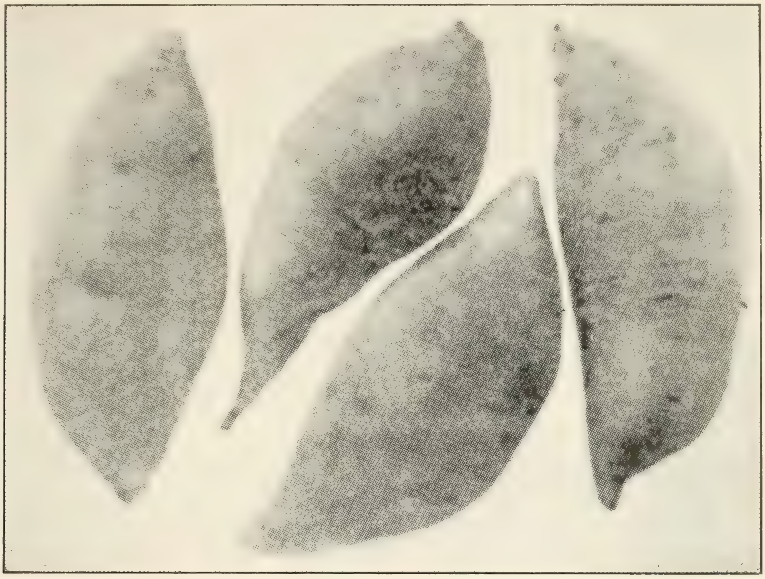


Figure 129, Nancy Hall

Judging Sweet Potatoes

1. **Trueness to Type:** The roots should be of uniform shape and color which are characteristic of the variety. There are several strains within the varieties which vary in color, and while the richer colored strains are usually preferred, uniformity of color is a more important factor in judging. The shape should not be too much like a turnip nor too long and slender, but more of an oval or spindle shape for the more popular varieties (Porto Rico or Nancy Hall).

2. **Freedom from Disease:** Any sign of any discolored diseased areas such as black rot, soft rot, scab, or stem rot on the tubers should be considered a serious defect. Scurf is less serious but undesirable.

3. **Size:** The most desirable market sweet potatoes range in size from 2½ to 3 inches in diameter and 5½ to 7 inches long. However, U. S. No. 1 grade allows sizes ranging from 1¾ to 3½ inches in diameter and 4 to 10 inches long.

4. **Uniformity:** Individual potatoes in a sample should be as near the same weight, shape and color as possible. The color should be uniform over the entire root.

5. **Market Quality:** Quality has to do with general appearance. The roots should be smooth and free from defects such as cuts, bruises and colored areas, and should be bright and clean.

Placing Card for Potato Judging

Contestant's No.__________Team No.__________Class__________

POINTS FOR COMPARISON	First	Second	Third	Fourth	Score
1. Uniformity					
2. Size and quality					
3. Appearance and condition					
4. Variety type					
5.					
6.					

Total__________

Average Score (I)

FINAL PLACING ORDER	First	Second	Third	Fourth	Score

(II)

Total__________

Final Score (Av. I & II)__________

Official Grades

U. S. No. 1 shall consist of sweet potatoes of similar varietal characteristics which are firm, not badly misshapen; free from black rot, decay and freezing injury; and free from damage caused by dirt, secondary rootlets, bruises, cuts, scars, growth cracks, scald, scurf or other diseases, weevils or other insects, and mechanical or other means. Diameter, 1¾ inches to 3½ inches; length 3 inches to 10 inches.

Tolerances—In order to allow for variations other than size incident to proper grading and handling, not more than 10 percent by weight of the sweet potatoes in any lot may be below the requirements of this grade, but not to exceed a total of 5 percent shall be allowed for defects causing damage, and not more than one-fifth of this amount or one percent shall be allowed for sweet potatoes affected with soft rot.

In addition not more than 10 percent by weight of the sweet potatoes in any lot may not meet the size requirements, but not more than one-half of this tolerance or 5 percent shall be allowed for sweet potatoes which are below the minimum size requirements.

U. S. No. 2 shall consist of sweet potatoes of similar varietal characteristics which are firm; free from black rot, decay and freezing injury; and free from serious damage caused by dirt, bruises, cuts, scars, growth cracks, scald, disease, weevils or other insects and mechanical or other means. Diameter, 1½ inches to 3½ inches; length, 3 inches to 10 inches.

Tolerances—In order to allow for variations other than size incident to proper grading and handling, not more than 10 percent by weight of the sweet potatoes in any lot may be below the requirements of this grade, but not to exceed one-tenth of this amount or one percent shall be allowed for sweet potatoes affected with soft rot.

In addition not more than 10 percent by weight of the sweet potatoes in any lot may not meet the size requirements, but not more than one-half of this tolerance or 5 percent shall be allowed for sweet potatoes which are below the minimum size requirements.

U. S. Fancy shall consist of sweet potatoes of similar varietal characteristics which are firm, smooth and well-shaped; free from black rot, decay and freezing injury; and free from damage caused by dirt, secondary rootlets, bruises, cuts, scars, growth cracks, scald, scurf, or other diseases, weevils or other insects and mechanical or other means.

The diameter of each sweet potato shall not be less than 2 inches, nor more than 3½ inches, and the length shall not be less than 3 inches nor more than 6 inches, but the length may be less than 3 inches if the diameter is 2½ inches or more.

Tolerances—In order to allow for variations other than size incident to proper grading and handling not more than 10 percent by weight of the sweet potatoes in any lot may be below the requirements of this grade, but not to exceed a total of 3 percent shall be allowed for defects causing serious damage and not more than one-third of this amount or one percent shall be allowed for sweet potatoes affected with soft rot.

In addition not more than 10 percent by weight of the sweet potatoes in any lot may not meet the size requirements, but not more than one-half of this lot tolerance or 5 percent shall be allowed for sweet potatoes which are below the minimum size.

Unclassified shall consist of sweet potatoes which are not graded in conformity with any of the foregoing grades.

Definition of Terms

"Similar varietal characteristics" means that the sweet potatoes in the same container shall have skins of similar color, such as white, yellow or red. Moist (Southern) and dry (Northern) types shall not be mixed.

"Firm" means that the sweet potato shall not be flabby or shrivelled.

"Badly misshapen" means that the sweet potato is so misshapen as to cause a waste for ordinary use of more than 20 percent by weight of the potato.

"Damage" means any injury which materially affects the appearance of the lot or causes appreciable waste in the ordinary preparation for use.

"Serious damage" means any injury not including misshapen potatoes which seriously affects the appearance of the lot or causes a waste of more than 20 percent by weight in the ordinary preparation for use. Black rot shall be considered as serious damage.

"Diameter" means the greatest dimensions at right angles to the longitudinal axis.

"Smooth" means that in addition to other defects which cause roughness, sweet potatoes shall be free from prominent veining.

Reference: Agricultural Education, Issued by the Division of Education, Clemson Agricultural College, Clemson, S. C., Volume 7, No. 6.

IRISH POTATOES

Irish Cobbler

An excellent table potato; tuber white, roundish, slightly flattened, blocky, deeply recessed at seed ends and stem ends. Eyes deep, sprout green, tinged reddish pink.

Plant: Stems medium light green, tinged with purple at nodes and base, leaves medium light green, glossy, broad. Flowers light rose-purple, under intense heat may be almost white.

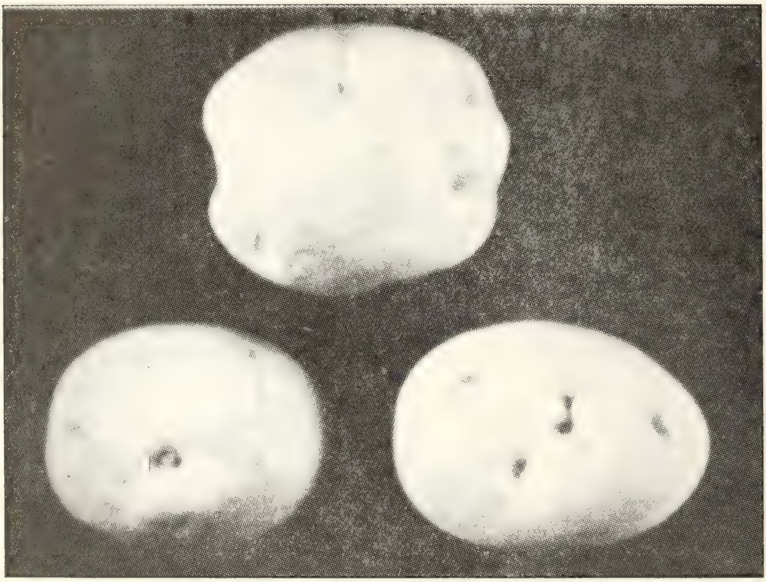


Figure 130, Irish Cobbler

Triumph

Size: medium; shape: roundish, blocky, slightly flattened; surface: fairly even; distal (bud) end: roundish to truncate (blunt); bud-eye cluster: large, lateral to central, medium to deep. Stem end: very truncate (blunt). Stem: small, central; cavity: very large, broad, deep to very deep, very irregular. Skin: thin, tender, solid red. Eyes: fairly numerous, medium in size, rather deep, reddish. Eyebrows: prominent, long, moderately curved. Flesh: fine, firm, juicy, white.

Standard Size of Tubers of Triumph Variety

Circumference longitudinal (lengthwise)	8¾ inches
Circumference latitudinal (crosswise)	8⅛ inches
Length	2¾ inches
Width	2¾ inches

Tubers of the above sizes will weigh about six or seven ounces.

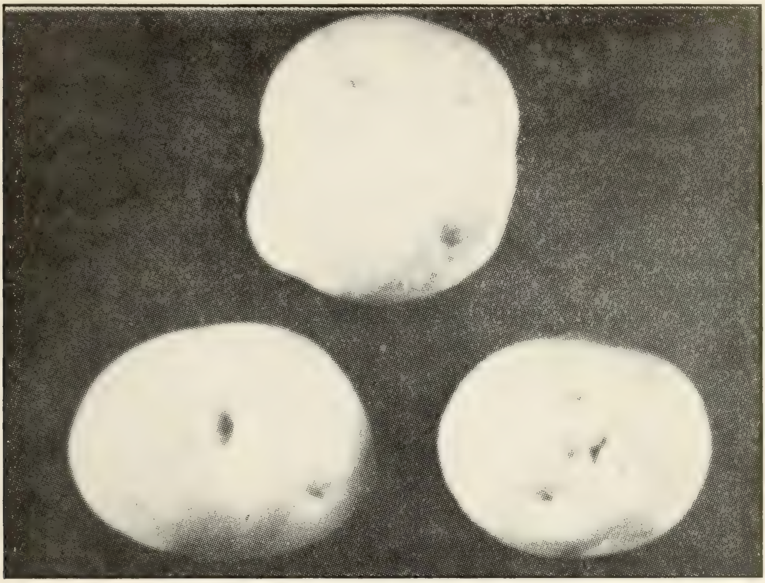


Figure 131, Triumph

Judging Irish Potatoes

1. **Trueness to Type:** Potatoes should be true to the type of the variety judged. Irish Cobblers are round, have rather deep eyes, and white skins. Tubers which do not have the true varietal characteristics should be placed below those which are more nearly of the right type.

2. **Freedom from Disease:** Diseases most likely to be observed are scab, Rhizoctonia, and rots. In a judging contest tubers are not usually cut to observe internal diseases. Scab causes rough, unsightly spots on the exterior of the tuber. Rhizoctonia occurs as small, hard, dark, colored bodies the size of a pin-head or larger, adhering to the skin of the tuber. They turn black when moistened. Samples showing disease should be placed according to the severity of the infection, the worst samples being placed last.

3. **Size:** Tubers may be as small as four ounces or as large as twelve ounces. The most desirable size is from six to eight ounces. If samples are larger or smaller than this they should be graded off accordingly.

4. **Uniformity:** This is considered one of the important points in exhibition products. The individual tubers should be as nearly the same size, shape and color as possible.

5. **Quality and General Appearance:** After the other points are judged, quality and general appearance should be considered. These indicate the general character of the sample and the care with which it has been selected and handled.

General Statement: In comparing samples of seed potatoes in regard to the above points bear in mind that **Trueness to Type and Freedom from Disease** are of almost twice as much importance as the other characteristics. These characteristics will influence the crop produced by such seed and are, therefore, of a great deal more importance than uniformity and general appearance. In judging **market potatoes, uniformity and general appearance** would be of almost as much importance as trueness to type and freedom from disease.

Reference: Agricultural Education, Issued by the Division of Education, Clemson Agricultural College, Clemson, S. C., Volume 7, No. 6.

SEED IDENTIFICATION

In seed identification it is necessary for the judge to know the characteristics of the seed to be judged. In this connection the description of a number of crop seed are given.

Legumes

Alfalfa

Description of Plant: Alfalfa may be described briefly as being a deep-rooted, long-lived herbaceous forage plant belonging to the botanical family Leguminosae, or pod-bearing plants. Its flowers are violet, clover shaped, and borne in compact oblong racemes, or clusters. The pods are small, slightly hairy and spirally coiled in two or three turns. The kidney-shaped seeds are about one-twelfth of an inch long, and several are contained in each pod.

One of the most important characteristics of alfalfa is its long tap-root, often extending 15 or more feet into the soil. This enables the plant to reach stores of plant food in the soil which cannot be secured by the ordinary shallow-rooted field crops. This long tap-root is also of great importance in sections of limited rainfall, as by this means the plant is enabled to withstand extremes of drought which would otherwise be fatal.

Description of Seed: Olive green to brownish green color, slightly kidney to angular in shape, similar in size and color to sweet clover.

Distinguishing Characteristics: Flowers, violet color; clustered raceme; seed pods, spiral and many seeded; three leaflets, upper one with short stem. Leaflets slightly notched at the tips only. Stipules at the base of leaf stem are narrow ing-shaped. Stems of young plants are square.

Alsike Colver

Description of Plant: Alsike clover is a perennial but it is usually classed agriculturally as a biennial. Many smooth stalks grow up from the crown root system. The stems bear smooth leaves, each with three leaflets. The flower heads vary in color from partly pink and partly white to all white or all pink. After the flower heads mature and fade they bend over and hang down.

The length of the stalks vary from 8 to 12 inches on poorer and dry soil to 1½ to 3½ feet on moist soils under most favorable growing conditions. Single from each leaf axil. The main axis keeps on growing instead of terminating in a flower or flowering branch. The leafy branches may in turn keep growing forming flower heads or smaller branches in the axil of each leaf.

The terminal heads are the last found, the older ones being successively lower on the stem. The stem, however long, may bear flower heads along its entire length. Due to its method of growth Alsike clover may be cut for hay over a longer period of time than other clovers.

Description of Seed: The seed are light to dark green in color, small heart shaped and about the same size as white clover seed.

Distinguishing Characteristics: The stems are smooth and weak. The main stem is branched but does not terminate in a flower head. thus different in respect from red clover. The branches off the main stem terminate in flower heads. They are small, roundish, and of a white to pinkish color.

The leaflets are joined at a common point but have no white spot in the center. The stipules at the base of the leaf stem are wide and wing-shaped.

Burr Clover

Description of Plant: Annual, much branched, 15 to 60 branches at the base, ascending and spreading, smooth; stems 15 to 30 inches long. Leaves petioled, three-parted; leaflet broad at the apex, pointed at the base, emarginate, cuneate, wavy, margin, ⅜ by ½ inch; stiples, small dentate. Flowers yellow, ⅛ inch long, in small heads of two to four. Pods ¼ by ¾ inch, spirally twisted in two or four coils; coils flat, veined, each provided with two rows of reflex prickles. Seeds three to five to the pod, ⅛ to 3/16 inch long, strongly kidney-shaped, deep yellow in color. Nitrogen tubercules forked, rather flattened, ⅛ to ½ inch in diameter. Native of Europe and Asia supposed to have been introduced into America in ship ballast.

Distinguishing Characteristics: Burr clover spreads over the ground with many branches during its growth. The leaves are trifoliate (three in a cluster) and usually have V-shaped black spots on them. The leaflets are broader at the apex than at the point of attachment.

The seed are borne in characteristic twisted pods with prickles attached. The seed are flat kidney-shaped and vary from yellow to bright brown in color. They are somewhat larger than either red clover or alfalfa.

Crimson Clover

Description of Plant: Although crimson clover is an annual, it has a semi-biennial habit, as it, when sown in the summer or fall, will mature during the spring of the following year. It is upright in its habits of growth, and under favorable conditions attains a height of twenty to thirty inches. From the crown of the root are developed four to thirty or more erect branches on which a large amount of foliage is produced. The stems and leaves are quite hairy. The heads are terminal, being some distance above the last leaves, and are somewhat longer than those of red clover. They are of a rich, crimson color and are strikingly beautiful in their appearance. The leaves are borne on long leaf stalks. It is much earlier in maturing than red, mammoth and alsike clovers. It grows late in the fall and starts growth early in the spring.

Description of Seed: They are egg-shaped, the largest of the clover seeds, and vary from flesh to reddish brown in color.

Distinguishing Characteristics: Crimson clover grows with the stem terminating in a spike-like raceme bearing the crimson flower. The stems and leaves are hairy. The leaflets are broader at the apex than at the point of attachment, and are much larger than the leaves of white clover. They also tend to be more rounding without the color marking that distinguish red and white clover.

Red Clover

Description of Plant: Red clover is a biennial and is especially adapted to short rotations. It is a herbaceous plant and is composed of numerous leafy stems arising from a thick crown. The stems and leaves are hairy, with each leaf having three leaflets. The flowers are rose-pink in color and they remain erect even after the flower fades. The main axis terminates in a flower and thus limits the growth of the stem. Branches arise from the leaf axis and these in turn are terminated by flowers. Thus the terminal flower head of the main stem or branch is the oldest of the plant or branch. The flower heads of red clover are not borne at exactly the same height from the ground. There is no great difference between the level to which the various flower heads rise.

Description of Seed: The seed are somewhat heart-shaped, deep purple to light yellow and mottled in color. They are about the size of alfalfa seed and somewhat smaller than crimson clover.

Distinguishing Characteristics: The stems and leaves are hairy. The main stems are strong and usually erect and terminate with the flower head limiting growth. The flower heads are large, slightly elongated, and of a purplish pink color. The leaflets are joined at a common point usually bearing irregular V-shaped white markings. The stipules at the base of the leaf stem are attached about three-fourths of their length.

Sweet Clover

Description of Plant: Sweet clover is an erect-growing legume with trifoliate leaves and white, yellow, or purple flowers. It is similar to and closely related to alfalfa and true clovers. In its early stages it is difficult to distinguish from alfalfa. All sweet clovers have a bitter taste and have, when bruised, a characteristic pleasant odor due to a substance within the plant known as cumarin.

The flowers are produced on long flowering stems, or racemes, which arise in the axils of the leaves. A raceme may bear as many as a hundred flowers. Most strains of white sweet clover (Melilotus alba) usually begin blooming in June about ten days after the yellow-flowered species (Melilotus officinalis). Blooming begins at the base of the raceme and continues to the tip. The normal blooming period for a single stem is ten days or two weeks, usually with not more than half the flowers on the raceme in bloom at one time. The shorter blooming period of the yollow species is due to the more rapid opening of the flowers.

Description of Seed: Seeds of sweet clover and alfalfa are often confused because of their similarity, the sweet-clover seeds are comparatively short and thick and alfalfa seeds are bean-shaped. Some unhulled seeds are frequently found in a sample of sweet clover. Sweet-clover seeds have a characteristic bitter taste and sweet odor and are slightly smaller and more oval in shape than alfalfa.

Distinguishing Characteristics: Flowers, white or yellow, produced on long flowering stems (racemes). Seed pods, dark in color bearing only one seed. Three leaflets, upper one with short stem, leaflets are notched all around the edge. Stipules are very narrow and bristle-like. The stems of the young plants are many sided; juice of stem bitter.

The seed are olive green to yellowish green to brown, somewhat smaller than alfalfa, uniform, oval in shape with distinct crease three-fourths the length of the seed.

White Clover

Description of Plant: White clover is a smooth perennial; the stems are slender spreading, creeping, and rooting at the joints; the leaves are trifoliate, leaflets being inversely heart-shaped, and the leaf-stalks long; the flowers are white to an occasional pale pink arranged in small globular heads on long stalks; the first is a small, usually four-seeded pod; the growing season in the South is almost the entire year except dry summer. White clover grows on a variety of soils. It is distributed throughout North America, except the extreme North and the extreme South.

Description of Seed: The seed are small heart-shaped and vary in color from yellow to brown.

Distinguishing Characteristics: White clover is a dwarf low growing legume with creeping stems which root at the joints. The white flower heads are borne on the end of the long stalks. The leaflets are inversely heart-shaped each marked with a white V-shaped spot.

Lespedeza (Common)

It is thought that common lespedeza came originally from the Orient and probably grew first at Charleston, South Carolina, about the year 1830, and was spread from there to various parts of the South. It was first grown for pasture. Later it was grown for hay. Common Lespedeza belongs to the species striata, and is an annual. It will stand heavier and closer grazing and will reseed itself better than other annual varieties.

Distinguishing Characteristics: The plant tends to grow erect but not as erect or as tall as Tennessee 76. The leaves are composed of three leaflets. The leaflets are long and narrow. The stipules are narrow and pointed.

The seed remain in the hull when threshed. They are shaped like a shield, with three distinct points opposite the base end.

Kobe Lespedeza

J. B. Norton, an explorer for the United States Department of Agriculture, found what proved to be Kobe lespedeza while on a trip in Japan during the year 1919. He gathered plant specimens near the city of Kobe, and later sowed them in his garden at Hartsville, S. C. The Coker Pedigreed Seed Company of Hartsville, S. C., grew the first seed crop from Mr. Norton's selection in 1923.

Kobe is characterized by larger leaflets, stems, and seed. The shape of the leaflets are about the same as common lespedeza, but are larger and broader. Kobe matures later than Korean but is a little earlier than Tennessee 76.

Distinguishing Characteristics: The plant is much larger than common and has longer and broader leaflets. The seed are larger than common lespedeza. Kobe seed are grayish brown while the common are chocolate brown.

Korean Lespedeza

Korean Lespedeza, as the name indicates, was first found at Sorai Beach in Korea by Doctor Ralph G. Mills. Korean lespedeza seed were sent by Dr. Mills to the United States Department of Agriculture trial grounds at Arlington Farm, Rosslyn, Virginia, about 1921. These seed were grown and proved to be the heaviest yielder of seed and forage of any of the varieties grown as far north as Washington, D. C.

The plant is larger and coarser than common. The leaflets have a distinctive shape in that they broaden toward the apex. The stipule is broad in comparison to the narrow stipule found on the common lespedeza.

Distinguishing Characteristics: The plant is larger and coarser than common, and its leaflets are more rounding while common is oblong or long and narrow in shape. The stipules of Korean lespedeza are much larger than common. The mature plants bear special flowering branches. These branches have elongated hairy leaves placed close together giving a feathery appearance. The flowers and seeds are borne in the axils of the leaves.

The seed are oval in shape, almost the same size as common, but smaller than the Kobe. They are grayish brown in color in the hull and purple when threshed free of the hull.

Lespedeza Sericea

Sericea lespedeza seed were sent to the United States from Japan by Dr. Seaman A. Knapp about 35 years ago. The first plants were grown on the Arlington Farm, Washington, D. C., several years before this date.

Professor Geralk McCarthy of North Carolina planted some seed on his farm near Raleigh, North Carolina. Descendants of the original plants may still be found in waste places on this same farm. Strange to say, this variety did not become important until introduced by the United States Department of Agriculture in 1923.

Sericea is a perennial, producing a large coarse plant during the second year's growth. Mature plants reach a height of 3 to 4½ feet on good soil. The stems are very woody with light green leaves, silky on top and hairy beneath. The stems are also covered with small white hairs. Sericea is best cut for hay when cut at not over 12 inches high.

Distinguishing Characteristics: The plant is branched and very large and woody. Leaflets are long and narrow and square at the tip and somewhat pointed at the base.

The seed in the hull are dark brown, when dehulled green and oval in shape.

Austrian Winter Peas

Description: The Austrian winter field pea (Pisum arvense) is a cool weather legume that closely resembles the garden or English Pea and the sweet pea in habit of growth and appearance. On fertile soil the climbing vines may reach a length of five or more feet.

The flower is reddish purple in color, resembling a small sweet pea blossom. Blooming generally commences in April.

The seed are of a brownish mottled color, somewhat larger than hairy vetch seed and are borne in small pods that ripen in May.

Distinguishing Characteristics: Plants similar to garden pea. Seed greenish-gray to brown, round and dimpled. They are about 5 mm. in diameter.

Hairy Vetch versus Smooth Winter Vetch

Hairy vetch is one of the oldest and most commonly used green manure crops of the cotton belt. Being one of the most winter hardy of the vetches, it seldom suffers any winter injury. It is usually considered as a winter annual, although it is often carried over into the second year as a biennial when sown in the spring. The stems are comparatively weak or viny, ascending only with support. It has a higher minimum of zero growing point than other vetches that are less winter hardy, so that in seasons with a low mean temperature less growth may be expected from this variety than from others with a lower zero growing point. In mild winters, however, or winters having a high mean temperature, hairy vetch may yield as heavily as any less hardy variety. The seed of this variety cannot be distinguished from that of smooth vetch, and the two varieties are being sold under the name hair vetch. In growth, however, the two varieties are very distinct, the hairy vetch having long hairs on the stems and leaves, while the smooth vetch has fewer and less conspicuous hairs. A tufted growth at the ends of the stems of hairy vetch is also characteristic. The flowers of hairy vetch are a little larger than those of smooth vetch and of less reddish-purple color.

Distinguishing Characteristics: Hairy is distinguished by beans covered by fine hair. Smooth vetch as the name indicates is free of hairs on leaves and stems. The seed of hairy and smooth vetch cannot be distinguished. The flower clusters are a little larger in hairy vetch than in smooth vetch. The hairy vetch plant is distinctly hairy while smooth vetch has very few or no hairs at all. A tufted growth at the ends of the stems of hairy vetch is also characteristic.

Velvet Beans

The velvet bean is the most vigorous-growing annual legume cultivated in the United States, the vines often reaching a length of more than 50 feet. The leaves are petioles and trifoliate. The mebranous leaflets, which are shorter than the petiole, are from 3 to 10 inches long and about two-thirds as broad, the terminal one being rhomboid-ovate and the lateral ones obliquely so. The flowers of the different varieties, which vary in color from white to dark purple, are 1 to 1½ inches long and are borne singly or in two's or three's in long pendent clusters.

Velvet bean pods are of two distinct types, one being covered with a dense, black, velvetly pubescence, as in the Florida and Alabama varieties, while in the other type the pubescence consists mostly of short white or grayish hairs, as in the Lyon and Chinese varieties. In all kinds, the pods are covered with more or less numerous short bristles which cause a slight irritation of the skin. Much of this pubescence falls off soon after maturity. The pods of some varieties are only 2 to 3 inches long, while those of others may reach a length of 5 to 6 inches. The seeds vary from nearly white to marbled brown, brown and black. Varieties which commonly produce marbled seeds produce occasionally an entirely white or an entirely colored seed.

Velvet beans have numerous rather fleshy surface roots, which are often 20 to 30 feet long and abundantly supplied with nodules varying from one-fourth to one and one-half inches in diameter. The plants are rarely attacked by root-knot and are immune to wilt.

Distinguishing Characteristics: Velvet beans have either a bunch or viney habit of growth. The leaves are petioled and trifoliate. The leaflets are shorter than the petiole, and the terminal one egg-shaped, and the lateral ones lobed. The pods are borne on a single raceme usually in large clusters. The seed are nearly spherical in shape, 10 to 12 mm long, to 10 mm wide, 6 to 8 mm thick. The hilum is usually surrounded by a light color mottled with brown but sometimes it is solid white or brown.

Biloxi Soybeans

Introduced under S. P. I. No. 23211 from Tangsi, China, in 1908. Plants stout, erect, bushy, maturing in about 165 days; pubescence, tawny; flowers, purple, 85 to 90 days to flower; pods 2 to 3 seeded; seeds dark brown with brown hilum, about 1,875 to the pound; germ, yellow; oil, 20.1 per cent.

Distinguishing Characteristics: Hilum and seed coat brown, seed large 10 to 11 mm long, 7 to 8 wide, 6 to 7 thick.

Laredo

Introduced under S. P. I. No. 40658 from Yangpingkwan, China, in 1914. In China this variety is said to be adapted to drier lands than other varieties. Plants, slender, erect, inclined to lodge on fertile soils, maturing in about 140 days; pubescence, tawny; flowers, both purple and white, 70 to 75 days to flower; pods, 2 to 3 seeded; seeds, black with black hilum, about 7,776 to the pound; germ yellow; oil, 14.0 per cent. The Laredo is highly resistant to wilt and nematodes.

Distingushing Characteristics: Seed covering and hilum, black, 6 to 8 mm long, 4 to 5 mm wide, 2 to 3 mm thick. Sides, flat, somewhat oblong to egg shape.

Mammoth Yellow Soybeans

One of the early importations, but exact date and origin seems somewhat indefinite. A late-maturing (140 day) seed type of bean adapted to a wide range of soil conditions.

Plant and Seed Characters: Plants erect, bushy, stems large and coarse; leaves medium size; pubescence, gray; flowers, white; pods, straw yellow; seed, medium large, 2,145 pound, almost spherical in shape; seed coat, cream buff; hilum, fawn color to bone brown (light to dark brown); cotyledons, yellow.

Distinguishing Characteristics: Seed, cream to straw color; hilum, light to medium dark brown, 7 to 8 mm long, 6 to 7 mm wide, 5 to 6 mm thick, somewhat spherical in shape.

Otootan Soybeans

Introduced from the Hawaiian Island in 1911 by C. K. McClennad, Georgia Agricultural Experiment Station. It is said to have come originally from Formosa. Plants, slender, erect, bushy, but lodging under favorable conditions, maturing in about 175 days; pubescence, tawny; flowers, purple, 90 to 95 days to flower; pods, 2 to 4 seeded; seeds, black with black hilum, about 6,150 to the pound; germ, yellow; oil, 17.7 per cent.

Distinguishing Characteristics: Seed covering and hilum black, 6 to 7 mm long, 5 to 6 mm wide, 4 to 5 mm thick. Spherical in shape.

Tokyo Soybeans

Introduced under S. P. I. No. 8424 from Yokohama, Japan, in 1902. Plants, stout, erect, bushy, maturing in about 140 days; pubescence, gray; flowers, both purple and white, 70 to 75 days to flower; pods, 2 to 3 seeded; seeds, yellowish green with pale hilum, about 2,260 to the pound; germ, yellow; oil, 18.4 per cent.

Distinguishing Characteristics: Seed, olive yellow; hilum, pale, 7 to 8 mm long, 6 to 7 mm wide, 5 to 6 mm thick, somewhat spherical in shape.

Virginia Soybeans

A selection from the Morse made by representatives of the U. S. D. A. in 1907. A medium-late 125 day bean of a hay type, doing unusually well on the poorer types of soil. Has a tendency to lodge badly on rich soils, but stand much better on poorer soils, giving a surprisingly large yield of either hay or seed under such conditions.

Plant and Seed Characters: Plants, slender, twining; leaves, medium size; pubescence, tawny; flowers, purple; pods, tawny and distributed throughout the length of the long, slender stem; seed, medium-small (4,092 per pound) oblong, much flattened; seed coat, medal bronze (greenish brown) to Prouts brown (dark yellowish brown); hilum, olive brown; cotyledons, yellow.

Distinguishing Characteristics: Seed coat and hilum olive to brown in color, 8 to 9 mm long, 5 to 6 mm wide, 4 to 5 mm thick; seed, flat, somewhat oblong to kidney shape.

Mamredo Soybeans

The Mamredo was developed from a black-banded yellow bean discovered by H. A. York in 1924 in a quantity of Mammoth Yellow soybeans which had grown in a field adjoining a field of Laredo soybeans. The Mamredo is, therefore, presumed to be a natural hybrid between these two varieties. The Mamredo is one of the Delta's best early high producing yellow beans. It makes a very good quality of hay and holds the beans well when first mature, but shatters somewhat after the beans have been ripe for some time.

Distinguishing Characteristics: Mamredo is semi-erect with twining terminals, medium in size with abundant stems and leaves, and matures in about 145 days. The pubescence is tawny and the flowers both purple and white, requiring 75 to 80 days to bloom. Pods are tawny and two- to three-seeded. The seed are yellow with tan and brown hilum and the germ is yellow. Approximately 3,220 seed are required to make a pound. Mamredo is one of the Delta's best early, high producing, yellow beans.

Mamloxi Soybeans

Mamloxi is a Mammoth Yellow-Biloxi hybrid, resulting from a cross made by H. A. York at the Delta Branch Experiment Station in 1925. Selections have been made from its progeny for a high-yielding, non-shattering, medium-early yellow bean. The type is now well fixed, though the seeds still have some reversionary brown markings. It has the production and color qualities of the Mammoth Yellow, and the non-shattering qualities of the Biloxi, and is a combination of the plant type of both parents. It has been one of the highest yielders of grain for the past ten years and is grown extensively over the Delta.

Distinguishing Characteristics: A Mammoth Yellow-Biloxi hybrid, is a high yielding non-shattering, medium early, yellow bean. It still has some reversionary brown markings. Pods are tawny and gray and flowers are purple and white. The plant is stout, erect, and bushy. It grows taller than the Mammoth Yellow and matures seed in about the same time, 145 to 150 days. The seed are yellow and about the size of the Mammoth Yellow, probably a little larger, requiring approximately 2,330 beans to a pound. It is very prolific. The beans are well retained in the pod during adverse weather. It is too coarse and woody for the best quality of hay, unless planted very thick.

Delsta Soybeans

Delsta is a high yielding grain bean, and medium to late in maturity. The plants are very stout, erect, and bushy, and mature in about 165 days. The flowers are white and require about 75 to 80 days to bloom. Pods are gray and two- to three-seeded. The seed are yellow, large, with about 1,860 beans to the pound. The Delsta shatters some if allowed to stand too long after fully matured. The hilum and germ are yellow. The stems are coarse and the leaves medium in size and late in maturity. It is a heavy yielder of grain but not a good hay bean. If planted thick enough it will make a good quality of hay. When given space, plants grow about 3½ feet high with several branches from the central stalk approaching the height of the main axis and spreading into a broad top.

Blackeye Cowpeas

The Blackeye varieties are quite numerous and are very similar to each other, the name applying in general to all white sorts with a black eye. The varieties of this group have been grown as a table vegetable since ancient times. One of the earliest forms is the Extra Early Blackeye, a sort adapted to the northern part of the cowpea region. The California Blackeye is grown quite extensively throughout the interior valley of California.

Distinguishing Characteristics: The seed coat is white with a blackeye. The size varies from small to large.

Clay Cowpeas

The term Clay is applied commercially to a group of medium-late varieties with buff-colored seed rather than to any one sort. The Iron cowpea is not included in the Clay group. There are many buff-seeded varieties, all of which have practically the same habit of growth, but they differ slightly in time of maturity, size and form of seeds. The sorts which mature their first pods in about 110 days or less make up the most of the seeds sold as Clay, while the sorts requiring 110 days or more to mature the first pods are called Wonderful or Unknown. On account of its large vigorous growth, the Clay group, especially the Unknown or Wonderful, is grown to a considerable extent for forage and soil improvement.

Distinguishing Characteristics: The seed coat is cream buff. The seed are medium sized and somewhat larger than Iron.

New Era Cowpeas

The New Era is one of the important commercial varieties of cowpeas. It is especially valuable on account of its earliness, its erectness, and the smallness of the seed. It usually produces a heavier yield of seed than the Whippoorwill. Plants, tall, erect, half bushy, very prolific; pods held high, the first maturing in about 75 days; seeds thickly and evenly speckled with blue.

Distinguishing Characteristics: The seed are buff with fine blue specks evenly distributed over the seed coat. The seed are similar to but smaller than Groit.

Whippoorwill Cowpeas

Probably more than half of the acreage of cowpeas in the United States is devoted to this variety. It is easily distinguished by its subreniform seeds, which are buff marbled with brown. This variety is also called Shinney and Speckled. It has been known in the United States for at least seventy years.

Groit Cowpeas

This is a cross between Whippoorwill and New Era, the seeds sharing the coloration of both parents, apparently superimposed on each other. It is larger and more prolific than New Era, and on the whole the best forage cowpea for states north of the cotton belt.

Grasses

Bermuda Grass

Bermuda grass (Cynondon dactylon) is so well known that a detailed description is unnecessary. Sometimes, however, the grass is confused with crabgrass or crowfoot, and water Bermuda grass. It is distinguished from all of these plants, however, by the ring of white hairs at the base of each leaf blade. Another conspicuous characteristic of the plant is the mass of creeping stems or runners which it produces. It is by no means exceptional to find runners many feet in length, usually forming a matted growth, well adapted to withstand grazing and trampling. The combination of the creeping stems above the ground and of rootstock immediately below the surface makes Bermuda grass pernicious when growing when it is not desired. From the creeping stems, upright branches arise at intervals to a height of 6 to 12 inches, and sometimes taller. Each flowering branch is crowned by a cluster of three to five slender ascending spikes arranged like the rays of an umbrella. The stems of the grass are compressed and consist of numerous joints, each of which, if separated, may grow readily into a new plant.

Distinguishing Characteristics: The plant is distinguished from the crab grass by a ring of white hairs at the base of the leaf blade. The flowering stems form a compound spike with 2 to 5 racemes which are joined at a common point. The plant has a creeping habit of growth by means of stems above and below the ground.

The seed are angular and pointed about the same size as carpet grass. They are light gray in color. They are 2 mm long and 1 mm wide.

Carpet Grass

Carpet grass (Paspulum compressum) is a slender, erect perrennial six to twenty-four inches high; the creeping branches root at the joints and send up numerous leafy, flower-bearing branches; the head consists of two to four slender branches, each two or four inches long; the plant produces seed freely; the growing season is April to October. Carpet grass is common on low ground and in moist pastures on the coastal plains from Virginia to Texas.

Distinguishing Characteristics: The plant is creeping in habit of growth with compressed buds and flat blades. The compound spike usually has 3 racemes, with two at the top joined together at a common point and one, rarely two or three, joined at different intervals down the stem.

The seed are flat-oval in shape and of medium size. They are full gray in color with a distinct hair base, 2 mm long and 1 mm wide.

Dallis Grass

Dallis (Paspalum dilatatum poiret) is known also under the names of large water grass, golden crown grass, and hairy-flowered paspalum. It is smooth perennial, with a deep, strong root system and grows in clumps or bunches 2 to 4 feet high. The leaves are numerous near the ground but few on the stems. The stems are slender and usually drooping with the weight of the flower clusters.

Dallis grass produces seeds rather freely, but owing to the fact that they ripen from the tip downward and shatter off as soon as ripe, good visible seeds can be gathered only by hand. Seed is high-priced and usually of low germination.

Distinguishing Characteristics: The plant produces erect flowering stems from a prostrate (flat) base. These stems bear 3 to 5 racemes originating at different points along the flowering stem. The spikelets are single flowered. The seed are flat-oval in shape 2 to 3 mm long and 2 mm wide.

Italian Rye Grass

Italian rye grass (Lolium multiflorum Lamarck; L. italicum R. Brown) is readily distinguished from perennial rye grass by the awn on each floret and by the young leaves being enrolled at first. The grass is not truly an annual, but under farm conditions few of the plants live more than one year. Each plant under favorable conditions make a round bunch with two or more flowering shoots 1½ to 3 feet high. Many varieties have been distinguished, based on different criteria.

Distinguishing Characteristics: The plant produces as many as twenty stems. The flowers are borne on a spike with 6 to 8 flowers per spikelet. The seed are medium large, about 7 mm long and 1.5 mm wide. The rachilla is flattened, narrow at the base and gradually widening out toward the summit. The Italian rye grass seed bear an awn while English rye do not.

Kentucky Blue Grass

Kentucky Blue-Grass (Poa pratensis) is with the possible exception of timothy, the most noted grass in North America. Perhaps on account of the famous blue-grass country in Kentucky the opinion prevails that the grass is a true native. Such, however, is not the case, the blue-grass did not grow in Kentucky when Boone discovered that attractive region. Like most of our best cultivated grasses, blue-grass is a native of the Old World, where it occurs natural over much of Europe and Asia. It was brought over by the early colonists as one of the species contained in mixed grass seeds, and, like some of the others, found the soils and climatic conditions congenial. The name blue-grass has been supposed to be due to the purplish color of the flowers, but there is good evidence that the name was first applied to Canada blue-grass, which has bluish foliage, and was later transferred to the really green plant now called Kentucky blue-grass.

Kentucky blue grass has creeping underground stems, each bearing a tuft of leaves at the tip. Unlike some other grasses Kentucky blue-grass blooms but once each season. When not in bloom it can usually be recognized by the leaves, which are V-shaped in cross sections, and by the peculiar leaf tip, which resembles the bow of a boat.

Distinguishing Characteristics: The plant produces a uniform sod by means of underground stems. The leaves are V-shaped on cross section with the tip resembling the bow of a boat. The mid-vein of the leaf blade is prominent, with a short ligule (little tongue) attached to the base of the blade. The flower head is open with the lower-most branches normally in a whirl of five branches. The spikelets are crowded with 3 to 5 flowers per spikelet.

The seed are medium sized, from 3 to 4 mm long. They are ovate, lanceolate, broadish near the center, and acute at tip in shape, and have brownish straw color. The seed have distinct veins on either of the mid-rib of the major glume.

Meadow Fescue

Meadow fescue (Festuca elatior) also called English blue-grass and, in the South, Randall grass, is a hardy perennial grass attaining a height of 15 to 50 inches, or even more on rich land. It does not propagate by root-stocks or form a heavy sod, neither is it inclined to be bunchy, as orchard or tall meadow oat grass. Its leaves are bright green and very succulent. The seed are produced in abundance in open panicles, similar to Kentucky blue-grass, although much larger and more easily harvested.

Meadow fescue is useful as a pasture grass, and it makes a very good quality of hay and gives a fair yield. On average 1 and 2 tons per acre is not exceptional, and it is possible to produce even more than this under proper treatment. Where the hay is used it is considered of very good quality, but it is nowhere grown in large quantities. Meadow fescue does not reach its highest state of productiveness as quickly as timothy but usually persists much longer.

Orchard Grass

Orchard Grass (Dactylis glomerata) is a well-known standard grass which is grown to some extent in nearly every state in the Union and quite commonly in the region east of the Mississippi River and north Alabama and Georgia. It attains most importance, however, in Kentucky, southern Indiana, Tennessee, North Carolina, Virginia, West Virginia, and Maryland, and seems thoroughly adapted to a variety of soils in these states. It was first cultivated in Virginia in 1760, although the grass is a native of Europe.

Orchard grass is readily distinguished by its large circular bunches, folded leaf blades, and compressed sheaths, and by the peculiar form of its flower heads. The shape of the head has suggested the common English name of cocksfoot. Its ability to grow in the shade of trees is responsible for the name orchard grass.

Distinguishing Characteristics: The plant grows in large circular bunches. Its leaf blades are folded. The sheaths are compressed. The flowers are borne in compact clusters on branched panicles.

The seed are from 8 mm to 9 mm long including awn point. It is strongly compressed and somewhat flattened on the sides, with the awn and tip forming a curve which makes the seed appear sickle shaped. The color of seed is pale yellowish white.

Redtop

Redtop (Agrostis alba) is the only grass of much prominence as a hay plant among the many grasses belonging to the genus Agrostis. It was early introduced into the American colonies. This grass has been known under many common names, such as white-top, fliorin, white bent, and herd's grass. As all of these names belong more properly to grasses they should not be used for redtop.

It is a perennial grass, with a creeping habit of growth, which make a coarse, loose turf. It matures at about the same time as timothy. The leaves are about one-fourth of an inch wide and the stems slender. The loose widely branched panicle has a reddish color at maturity.

No other grass will grow under as great a variety of conditions as redtop. It is the best wet-land grass among the "tame" species. It will grow on soils so very poor in lime that most other grasses fail. It is strongly drought resistant and is often used for holding banks to prevent erosion. Redtop is second only to blue-grass as a pasture plant in the northeastern part of the country. It is a vigorous grower and will form a good tuft in a short time.

Most of the seed of redtop is produced in southern Illinois. The seed is smaller than that of any other commercial grass and for that reason should be comparatively free from impurities, as it is easily separated from other seeds by screening.

Distinguishing Characteristics: The slender stems with the loose, widely branched reddish panicles and single flowered spikelets make it easy to identify as a plant. The seeds are very small, both hulled and unhulled. They are slender and pointed and silver-whitish and amber.

Sudan Grass

Under cultivation in the United States, Sudan grass has shown itself to be distinctly an annual. Only under practically frost-free conditions, such as obtained along the Gulf Coast and in Southern California, have plants lived over winter. This grass is very closely related to the cultivated sorghums though for many years Johnson grass has been credited by some botanists with being the primitive form of the sorghums.

Sudan grass when seeded broadcast or in drills grows about 3 to 5 feet high and has stems about three-sixteenths of an inch in diameter (a little smaller than a lead pencil). If grown in rows and cultivated, it reaches a height of 7 to 8 feet and stems are about ¼ inch in diameter. The panicle is loose and open, very much like that of Johnson grass, but a little larger and a little less open. The hulls or glumes are awned and when in flower are often purplish in color. This color usually fades to a pale yellow when ripe. The awns are broken off in threshing, so that the commercial seeds rarely have awns. The leaves are broader and more numerous than those of Johnson grass, giving the grass a much more favorable appearance as a hay plant. The most important difference, however, is that the aggressive underground stems, or root-stocks, with which Johnson grass is equipped, are entirely absent in Sudan grass. Sudan grass, like the cultivated sorghums, never develops anything but fibrous roots, therefore, it cannot become an obnoxious weed as the perennial Johnson grass does. Furthermore, it has shown no tendency to persist in fields as an annual weed through volunteer seeding.

Distinguishing Characteristics: The only way to distinguish the plant from Johnson grass is by the absence of root-stock. Sudan grass does not have root-stock. The seed are usually larger and have only a third or less of the red colored seed. The two rachillas of the Johnson grass seed have rachilla that tend to remain on the seed, and the top portion of the rachilla is larger than the base. The seed are oval, somewhat flattened and pointed. They are 5 to 6 mm long and 2 to 3 mm wide.

Johnson Grass

Johnson grass is a perennial, reproducing by seed and underground root-stocks. This weed is wide-spread throughout the southern states and is limited in the North by severe winter freezing.

Description: Johnson grass grows erect 3-6 feet tall depending on the fertility and moisture in the soil. The habit of growth, the stem and leaves are similar to the cultivated sorghums and Sudan grass. The flowering heads are open and many branched quite similar to the flowering heads of Sudan grass, however, Johnson grass has a larger number of flowering head with reddish colored seed.

Distinguishing Characteristics: Johnson grass is very similar to Sudan grass in appearance. It is distinguished by the presence of root-stocks. The seed are oval-flattened and somewhat pointed in shape. The seed coats are thick and glossy, the majority of them being a dark reddish color, the remaining straw color.

Timothy

Timothy (phleum pratense) is one of the best known of all grasses and is not likely to be confused with any other.

Timothy is well adapted to the northern half of the United States and somewhat farther southward in the mountains. The southern limit of its successful culture is approximately the same as the northern limit of cotton culture. To the northward it will produce well and survive the winters practically up to the Arctic.

Timothy differs in one respect from most other grasses in that one (sometimes two) of the lower internodes is swollen into an ovoid body, referred to as a "bulb" or "corm" but in reality only a thickened internote. Each one of these "corms" is annual in duration, forming in early summer and dying the next year when the seed matures.

Timothy consists of many different strains, so that there are large possibilities of improvement by selecting the most desirable forms. Already much has been done along this line to produce improved varieties.

Timothy is a perennial with erect, simple stems one to four feet high, and with a dense, cylindrical, spike-like panicle one to four inches long. This grass is a native of Europe, but is now much cultivated throughout the North and is naturalized throughout the whole country. Wild plants are occasionally found in Mississippi.

Distinguishing Characteristics: It grows in clumps and is erect with simple stems. Its blades are flat and elongated. The panicles are dense, cylindrical and spike-like. The spikelets are single-flowered and laterally compressed. The seed thresh in the hull unless harvested in an over-ripe condition. The seed are small, from 1.5 mm to 2 mm long. Hulled seed are roundish in shape and acute at the base. Unhulled seed have a silver white color, while the hulled seed are light amber color.

Small Grains and Peanuts

Spanish Peanuts

Small podded variety, strong grower, stems upright, foliage abundant and heavy; pods clustered about the base of plant; usually two seeds in a pod, entirely filling the pod; color of peas light brown, pods adhere well to plant in digging. This variety frequently yields 60 bushels of marketable peas and a ton of hay to the acre. The peas of this variety are rich in oil content. The weight per bushel of Spanish peanuts is 30 pounds.

Distinguishing Characteristics: Small-podded variety with two seeds per pod. The seeds are light brown in color.

Virginia Bunch Peanuts

Large podded variety, plant rather dwarf, stems upright, foliage rather light; pods clustered about the base of plant; usually two, sometimes three seeds in a pod, pod bright and clean, color of peas light brown; pods adhere well to plants in digging. The customary weight per bushel of this variety is 22 pounds.

Distinguishing Characteristics: Large-podded variety, two and sometimes three seeds in a pod. Seed, light brown in color.

Fulghum Oats

The Fulghum oat has recently come into prominence in some sections, particularly where the Red Rustproof has been practically the only variety grown for decades. It was first grown extensively in southeastern Georgia, where it is believed to have originated. It is an awnless selection of Red Rustproof. This new variety soon became widely distributed in adjoining states, and it is now second to Red Rustproof in importance among fall-sown oats. It matures about 10 days earlier than Red Rustproof and the grain is usually lighter in color. In the field the Fulghum can be readily distinguished from the Red Rustproof by its more erect heads or panicles. The kernels of the Fulghum also are smaller and nearly free from the awns and basal hairs, characteristic of that variety; consequently its weight per bushel is usually higher. As it yields nearly or quite as well, its earliness gives it a distinct advantage.

Grain Description: Plump, uniform grain somewhat smaller than Red Rustproof, Fulghum is supposed to be awnless, however, on analysis, the grain may show 10-15 per cent awned. The lower grain may bear an awn, but the upper grains never bear awns.

Distinguishing Characteristics: Fulghum is distinguished from Red Rustproof by per cent of awns on back of grain. Fulghum grain about 15 percent awned. Red Rustproof grain practically all awned.

Abruzzi Rye

Introduced from Italy by the U. S. Department of Agriculture. Especially adapted to the Southern States. Superior to common rye as a winter cover crop, pasture, and green manure.

Abruzzi rye is a fall-sown crop, out yielding common rye for grain, as well as other uses in North Carolina. Abruzzi is 10 days to 2 weeks earlier in maturity.

Distinguishing Characteristics: Abruzzi rye grain is large and plump. From light gray to dark brown in color. A pure Abruzzi grain, does not contain a distinct greenish color.

Tennessee No. 6 Barley

The Tennessee No. 6 Barley is one of the many hybrids resulting from crosses made by the Tennessee Agricultural Experiment Station, between Tennessee Winter (Bearded) and Horsford (Hooded) and Union Winter (Bearded) and Horsford (Hooded) crosses. The resulting hybrids were tested in 1920 and 1921. The hybrids No. 5 and No. 6 were found to be the best of the lot. In later tests by the Station the Tennessee No. 6 Barley has proven to be inferior as a grain crop.

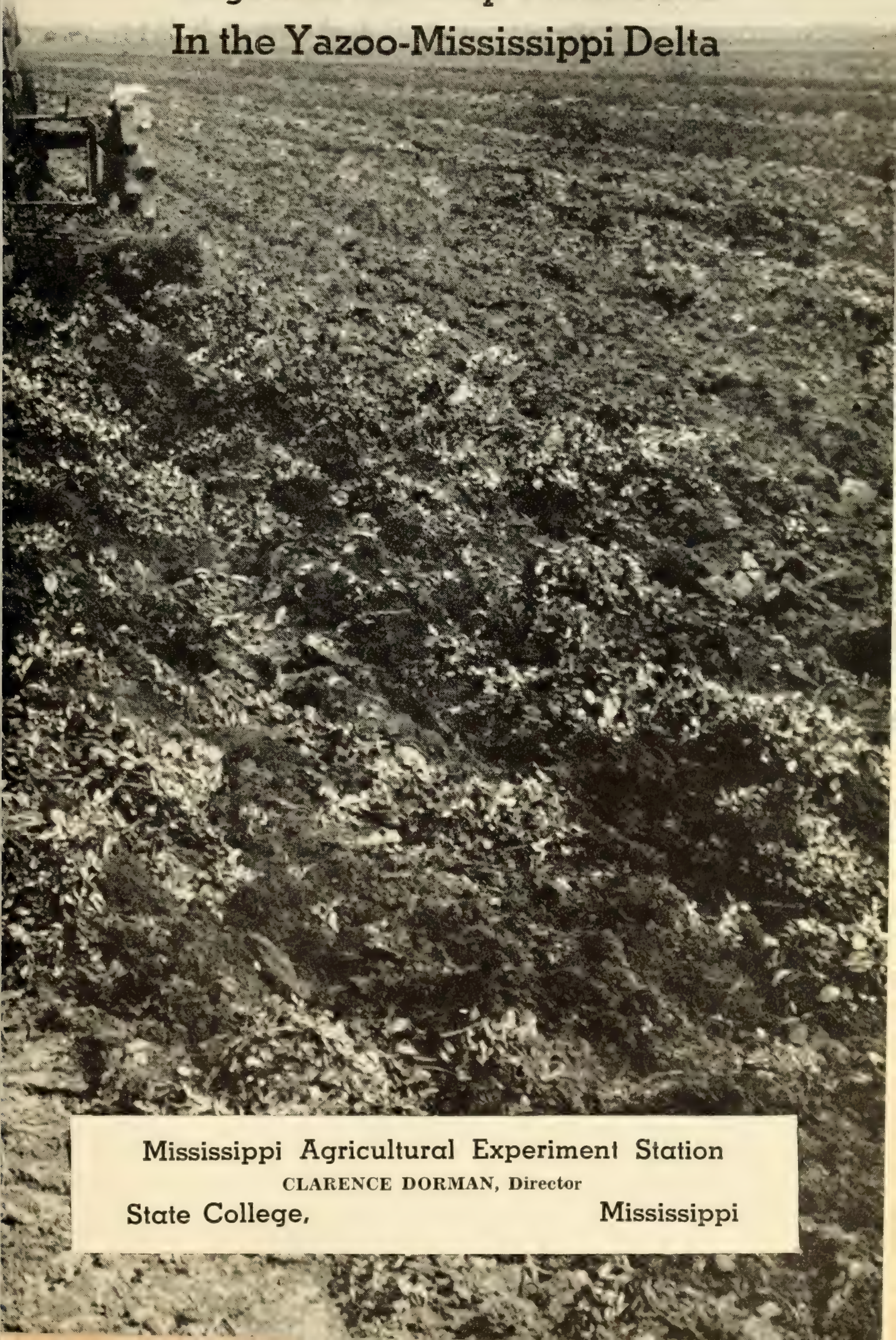
Distinguishing Characteristics: The six-row Barley having a hood-like formation at the apex of the inner glumes or chaff.

The seed hulls adhere closely to the kernel. Theoretically two-thirds of the grain are slightly twisted, one-third plump and straight. The threshed seed usually contain remnants of the hood as borne on inner glumes.

Reference: Agricultural Teachers' Series Bulletin 1, "Crops Judging Helps", Department of Education, State College Station, Raleigh, North Carolina.

Bulletin No. 345 July, 1940

Legumes for Crop Production In the Yazoo-Mississippi Delta



Mississippi Agricultural Experiment Station
CLARENCE DORMAN, Director
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SUMMARY AND CONCLUSIONS

The results of 10 years of experimental work with winter and summer legumes consisting of variety comparisons, rates and dates of seeding, dates of turning, method and dates of turning, and comparisons of the soil fertility value of both winter and summer legumes at the Delta Branch Experiment Station and in several Delta counties, may be summarized as follows:

Seeding winter legumes. Results indicate that winter legumes should be seeded at the following rates per acre: hairy vetch 25 pounds, Hungarian and common vetch 30 pounds, and Austrian peas 35 pounds, when planted on beds. These rates should be doubled when broadcast. Giant bur clover (unhulled) 10 bushels to 15 bushels, and California bur clover 15 pounds per acre. Winter legumes produce best results when planted in October, except unhulled bur clover, which seemed best planted in August.

Turning winter legumes. Best results were obtained when winter legumes were thoroughly disked and completely covered when bedded, and very little difference was obtained from medium, early, and late turnings.

Cost of winter legumes. Winter legumes and equivalent commercial nitrogen cost approximately the same per acre.

Fertility value. Ten-year average results show hairy vetch was equal to 55.4 pounds of commercial nitrogen on the Delta Branch Experiment Station, and increased cotton more than did 30 pounds of nitrogen every year except one.

In outlying tests, hairy vetch was equivalent to 34 pounds of commercial nitrogen in the Schaefer field, to 33 pounds in the Atkinson field, to 30 pounds in the Hemphill field, to 27 pounds in the Ladd field, and to 45 pounds of commercial nitrogen in the Smith field.

California bur clover was grown to advantage in the Atkinson field, seemed better adapted to the soil in the Hemphill field than other winter legumes, and was superior to other winter legumes in the Ladd field.

Winter legumes in all fields returned an average net profit of 18 cents to 40 cents for each pound of seed planted.

Fertilizing cotton following winter legumes was not profitable in the experiment; however, during the year 1939 increased yields were obtained from additional nitrogen on the Heathman field, and from nitrogen, phosphorus and lime on the Gary field.

Fertilizing winter legumes. Better crops of winter legumes were obtained in the three outlying fields nearest the loessial hills by applying 500 pounds of basic slag and 100 pounds muriate of potash per acre. Such applications were not found necessary in the West Delta nor in the Tallahatchie-Yazoo basin.

Summer legumes. Soybeans interplanted with corn did not decrease corn yields the first year, and gave an increase of nearly 15 bushels per acre the second. The beneficial effects continued into the second year when followed by cotton. Cowpeas and crotalaria also gave good increases in yields.

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Legumes For Crop Production In the Yazoo-Mississippi Delta

By ROY KUYKENDALL, Agronomist
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Since a sufficient amount of available nitrogen represents the difference between a profitable and an unprofitable crop on most Delta soils, legume production occupies a very important place in Delta agriculture as a source of that much needed nitrogen. Probably a larger acreage of legume crops is grown in the Delta for soil building than in any other equal area in the United States In the Fall of 1938 approximately 15 million pounds of winter legume seed were planted in the Delta counties. This 15 million pounds of seed planted approximately 330,000 acres of cotton land. A total of 765,000 acres of legumes were grown in 1938.

Summer legumes are also grown extensively throughout the Delta. Soybeans, cowpeas, lespedeza, and crotalaria constitute the principal annual summer legume crops for soil building. Very beneficial residual effects are also obtained in alfalfa production on crops following alfalfa.

The purpose of this bulletin is to discuss the production of legumes and the beneficial results obtained therefrom in the Yazoo-Mississippi Delta.

The Delta is fortunate in that winter legumes can be grown in the majority of this area more successfully than in any other section of the South. This is partially due to a sufficient amount of moisture at planting time and to a sufficiency of lime and other bases, as well as phosphorus and potash, that are necessary for successful legume production.

In most parts of the Delta it is not necessary to fertilize winter legumes; however, high yields of cotton are produced following winter legumes, and large quantities of plant food are removed by high cotton yields. Therefore, there is a possibility of depleting the soil of lime and other bases, as well as other plant food elements by a long time continuous legume program. It is to be presumed that lime and other bases, as well as phosphorus and potash, may be applied whenever their need is indicated

On the east side of the Delta, winter legumes have not been grown as successfully, because soils are more acid and, in some instances, deficient in phosphorus and potash. Under good management, winter legumes are being produced profitably in the East Delta area.

Successful production and use of winter legumes depend upon: (1) kind planted, (2) rate of seeding, (3) date planted, (4) method of seeding, (5) date of turning, and (6)method of turning. The value of the winter legume crop is determined by (1) the amount of nitrogen turned under, (2) cost per acre, and (3) the results obtained from the legume nitrogen.

Austrian Peas, Vetch and Bur Clover Are Winter Legumes Most Commonly Planted in the Delta

The principal winter legumes planted are Austrian peas, hairy vetch, Hungarian vetch, common vetch, early giant bur clover, and California bur clover.

Austrian peas are more susceptible to diseases, winter injury, poor drainage, and plant lice damage; but they can be turned under a week or ten days earlier than the vetches. Hairy vetch is less susceptible to diseases, winter injury, poor drainage, and insect damage than all other winter legumes but makes its maximum growth about a week later than Austrian peas. Hungarian vetch is similar to Austrian peas in its susceptibility to winter injury and poor drainage. Hungarian vetch apparently is not adapted to as wide an area and conditions as hairy vetch and Austrian peas. Some common vetches seem to be very hardy, vigorous growing, and as disease resistant as hairy and Hungarian, whereas others are not.

Early giant bur clover makes an early vigorous growth and can be turned under earlier than the vetches or Austrian peas. Bur clover seems to be gaining preference over other winter legumes, because it affords an opportunity for planters to harvest their own seed for future plantings. There is always a possibility of maturing sufficient bur clover seed for another crop if allowed to stand until the middle of April. This will permit planting cotton the first of May provided the clover is planted early and comes up to a stand in the fall.

California bur clover is similar to giant in earliness of plant growth and can be turned under at about the same date. It is considerably later in maturing seed than giant bur clover and apparently is not as well suited for seed harvesting. Bur clover seems to be more attractive to cutworms than the vetches and Austrian peas. It also adds considerably more nitrogen to the soil when turned under, but has failed to increase cotton yields as much as hairy vetch. Other clovers such as alsike, crimson, red, white Dutch, hop, black medic, Persian, Melilotus alba, Melilotus indica, and Melilotus officinalis can be grown for soil fertility purposes when planted in the early fall but fail to make the tonnage as the other winter legumes mentioned. Most of them can be used advantageously in permanent pastures.

Rates, Dates, Methods of Seeding Determined In Series of Experiments at Stoneville

Rates of Seeding

One of the first factors to be considered in growing winter legumes for soil building is how much seed to plant per acre. The method and date of seeding will have some bearing on the rate of seeding. In 1934, work was started at the Delta Station to determine the most economical rate of seeding hairy vetch, Hungarian vetch, and Austrian peas. These legumes were planted with a one-row planter equipped with a duplex hopper with plates to vary the amount of seed per acre and a middle-buster type of plow for covering the seed. The same plates were used every year, but the various rates of seeding fluctuated somewhat, because the size of seed varied from year to year. This test was located on Sharkey loam soil. In 1938 the Austrian peas were damaged severely by diseases, which prevented a completion of the test.

The results of the rate of seeding experiment are presented in table 1, in which are shown the production of nitrogen for four rates of seeding of hairy vetch, Hungarian vetch, and Austrian peas for the four years, 1934-1937.

The results of this experiment indicate that 18-25 pounds of hairy vetch, 25-30 pounds of Hungarian vetch, and 30-40 pounds of Austrian peas per acre are sufficient for maximum yields of nitrogen when the seed are planted in cotton rows during the first half of October. The general opinion is that these rates should be doubled when broadcast, and increased if planted after the first of November.

Experience through observations indicates that clean seed of California bur clover should be seeded at the rate of 10-20 pounds per acre broadcast on old or new seed beds and covered lightly. Giant bur clover should be seeded at the rate of 10-15 bushels per acre the first year.

Dates of Seeding

Another important factor to be considered is the proper date to plant winter legumes for most favorable results in succeeding crop yields. In many instances where less than optimum results are obtained from winter legumes, they may often be identified with late plantings in the fall.

The results of the dates of seeding experiment are presented in table 2, in which are shown the amount of growth and pounds of nitrogen produced in the plant tops from six dates of seeding hairy vetch, Hungarian vetch, and Austrian peas for the three years, 1933-1935.

These data show that the above-ground nitrogen decreases rapidly when winter legumes are planted later than November 1 and turned under around the middle of April. However, 62.5 pounds to 97.4 pounds of nitrogen per acre was produced in winter legumes planted as late as December 1. The dates for seeding California bur clover are the same as for the vetches and Austrian peas.

Method of Seeding

The most common method of planting Austrian peas and the vetches is with a one-row planter made especially for this purpose, described above. The planter may be run down the old cotton middles in the fall, drilling the seed on each side upon the old row with the middle-buster covering the seed and providing drainage during the winter months. Practically the same results may be obtained by broadcasting the seed and running any type of middle-buster in the old middles that will leave the dirt on top of the old cotton rows. This method of planting is used when the seed are planted before cotton harvesting is completed. It should immediately follow the first picking, in order to prevent damage to the cotton.

On loam soil where cotton picking is finished by the last of October, the land

A Field of Waist-High Hairy Vetch on the Delta Branch Experiment Station should be bedded, harrowed off, and the seed planted in one drill on top of the new beds with either a one or two-row planter with seed hoppers and planter plates that will deliver the desired rate of seeding. This method permits fall plowing, affords clean seed beds, and proper drainage. Austrian peas and the vetches can also be planted with a grain drill on land that has been plowed flat, or they may be broadcast on flat land or in old cotton rows, then stalks cut, and disked in flat. However, under these conditions, the rate of seeding should be increased when this method is used. Favorable results have also been obtained by broadcasting these seed on old cotton middles and bedding on them by plowing the old rows out with tractor or mule-drawn middle-busters. With excessive rain during the planting season, fair stands of Austrian peas and vetches have been obtained by broadcasting the seed and not covering them. Seeding peas and vetch by airplane in wet weather has not proved entirely satisfactory.

Giant bur clover can be scattered by hand or in any other preferable way on cotton land and left uncovered or scratched in lightly. This is usually done when the seed are harvested or about lay-by time or soon thereafter. The most satisfactory way to plant clean California bur clover seed is to broadcast either on old rows or new beds and harrow in lightly. These seed can also be planted with an alfalfa drill on flat prepared land.

Dates of Turning

The problem of turning under winter legumes at the proper date is important and has not been satisfactorily solved at present. From information gathered, it appears that turning should be done in time for sufficient decomposition to take place so that the turned under material will not be a hindrance to the succeeding crop production. Delayed turning increases cutworm damage and leaves a poor seedbed. A date of turning experiment was conducted from 1931 to 1936, in which two different turnings were made each year to determine the most satisfactory date of turning winter legumes for maximum succeeding cotton yields. The various winter legumes were planted on the same dates, and cotton was planted on the same date for both turnings. These turnings, however, probably did not begin early enough to answer questions in the minds of winter legume growers today. Recent work indicates that probably winter legumes can be turned earlier than formerly thought, with good results. The results of the dates of turning experiment are presented in table 3, in which are shown the amount of nitrogen turned under in the tops, and the following cotton yields, for two dates of turning Austrian peas, hairy vetch, and abruzzi rye compared with 30 pounds of commercial nitrogen for the six years, 1931-1936.

The difference between the increased yields from the two turnings of the winter cover crops are probably not significant, and more work is needed on this problem to be conclusive.

In 1939 another experiment was begun to compare the effects of turning bur clover at various stages of growth, on cotton yields and on soil reactions. This experiment was started on Sarpy loam soil that had a thick stand of volunteer bur clover which had matured seed the previous year. These turnings were made on March 3, March 16, April 3, and April 10 when the clover was 4, 10, 24, and 34 inches in height, respectively. Nitrogen data and cotton yield records for this one year's work are presented in the following table 4.

There is probably no significant difference in yields due to the date of turning. However, the increased yields due to the bur clover and commercial nitrogen are low, which indicates that even the plats receiving no nitrogen had a sufficient amount for optimum yields. It should be noticed, however, that the earliest turning produced the highest cot-

TABLE 1—ABOVE GROUND NITROGEN PER ACRE AND OTHER DATA FOR FOUR RATES OF SEEDING HAIRY VETCH, HUNGARIAN VETCH, AND AUSTRIAN PEAS

Winter Legume	Annual												Average 1934-37		
	1934			1935			1936			1937					
	Lbs. Seed per Acre	Inches Growth	Lbs. N. per Acre	Lbs. Seed per Acre	Inches Growth	Lbs. N. per Acre	Lbs. Seed per Acre	Inches Growth	Lbs. N. per Acre	Lbs. Seed Per Acre	Inches Growth	Lbs. N. Per Acre	Lbs. Seed Per Acre	Inches Growth	Lbs. N. Per Acre
	Planted—Oct. 2 Turned—April 11			Planted—Oct. 27 Turned—April 15			Planted—Oct. 12 Turned—April 3			Planted—Oct. 11 Turned—April 12			Planted—Oct. 13 Turned—April 10		
Hairy Vetch	22	36	131.1	19	34	67.5	17	30	84.6	16	34	61.2	18	33	86
Hairy Vetch	22	36	148.7	22	34	53.0	20	30	70.0	21	34	56.2	21	34	82
Hairy Vetch	26	36	134.0	27	34	59.8	25	30	82.4	26	34	63.7	26	34	85
Hairy Vetch	44	36	138.2	39	34	83.1	40	30	80.6	34	35	57.6	39	34	90
Hungarian Vetch	18	30	125.2	22	24	51.0	19	20	71.8	21	15	72.7	20	22	80
Hungarian Vetch	26	30	156.0	25	24	68.7	22	20	89.5	26	17	70.2	25	23	96
Hungarian Vetch	37	30	141.2	32	24	63.5	30	20	84.4	32	18	75.0	33	23	91
Hungarian Vetch	44	30	132.2	45	24	69.4	41	20	86.3	45	20	65.8	44	24	88
Austrian Peas	18	24	93.6	20	30	59.8	19	24	55.4	17	22	68.2	19	25	69
Austrian Peas	22	24	119.9	20	30	63.3	22	24	42.8	20	23	71.6	21	25	74
Austrian Peas	29	30	120.7	31	30	58.3	25	24	53.1	26	18	46.1	28	26	70
Austrian Peas	44	24	147.8	42	30	55.9	37	24	57.7	37	25	77.2	40	26	85

ton yields, which is an indication that where perfect stands are present, bur clover might be turned when it has four to six inches growth and produce maximum cotton yields without cutworm injury and other unfavorable results due to late turning. Since this is only one year's work, the results are not conclusive.

Method of Turning

The method of turning winter legume crops influences the benefits obtained from that crop. The method most commonly used with best results in the Delta is to disk the legumes sufficiently to cut them up, and then bed the land with a middle-buster. This completely covers the legume, thus hastening decomposition and reducing cutworm damage. The beds are disked and allowed to stand until planting time. Cotton then may be planted on the bed over the covered and decomposing legume.

TABLE 3—ABOVE GROUND NITROGEN PER ACRE AND YIELDS OF SEED COTTON FROM TWO DATES OF TURNING AUSTRIAN PEAS, HAIRY VETCH, AND ABRUZZI RYE

Treatment	1931	1932	1933	1934	1935	1936	Average Yield	Average Increase
First Turning								
Date turned	Mar. 18	Mar. 29	Apr. 7	Mar. 22	Apr. 2	Mar. 30	Mar. 28	
Date legume planted	Oct. 20	Nov. 5	Oct. 1	Oct. 2	Oct. 10	Oct. 12	Oct. 13	
Date cotton planted	May 1	May 1	May 1	April 25	May 4	May 3	May 1	
Pounds of Nitrogen per Acre								
No nitrogen	0	0	0	0	0	0	0	.....
30 lbs. nitrogen	30	30	30	30	30	30	30	....
Austrian peas	57.17	88.27	33.98	73.71	60.50	39.70	58.89	....
Hairy vetch	58.83	45.62	50.73	76.68	58.90	31.70	53.74	....
Abruzzi rye	....	....	....	....	....	....	....	......
Pounds of Seed Cotton per Acre								
No nitrogen	692.7	760.5	1248.8	788.4	944.6	805.0	873.3	....
30 lbs. nitrogen	850.5	679.5	1666.8	1096.2	1062.0	936.9	1048.7	175.4
Austrian peas	1029.7	773.0	1635.3	1414.2	1240.5	1176.3	1211.5	338.2
Hairy vetch	902.4	703.4	1779.6	1462.5	1616.0	1250.1	1285.7	412.4
Abruzzi rye	654.2	468.0	1118.9	814.2	760.7	728.6	757.4	—115.9
Last Turning								
Date turned	April 3	April 13	April 22	April 10	April 15	April 21	April 14	
Date legume planted	Oct. 20	Nov. 5	Oct. 1	Oct. 2	Oct. 10	Oct. 12	Oct. 13	
Date cotton planted	May 1	May 1	May 1	April 25	May 4	May 3	May 1	
Pounds of Nitrogen per Acre								
No nitrogen	0	0	0	0	0	0	0	.....
30 lbs. of nitrogen	30	30	30	30	30	30	30	....
Austrian peas	92.84	91.84	50.27	111.74	83.10	66.80	82.77	.....
Hairy vetch	126.59	59.04	74.93	104.21	100.60	50.80	86.03	....
Abruzzi rye	....	....	....	....	....	....	....	.....
Pounds of Seed Cotton per Acre								
No nitrogen	723.5	587.4	1276.0	873.5	955.4	862.6	879.7	......
30 lbs. nitrogen	826.0	698.4	1850.4	1228.5	1233.0	987.3	1137.3	257.6
Austrian peas	872.7	838.6	1945.1	1495.8	1653.9	1063.2	1311.6	431.9
Hairy vetch	695.7	876.3	1785.9	1575.1	1790.6	1297.7	1336.9	457.2
Abruzzi rye	638.0	489.0	1173.2	681.6	801.5	609.6	732.2	—147.5

TABLE 4—DATES OF TURNING BUR CLOVER FOR COTTON PRODUCTION, 1939

Date Turned	Inches Growth	Pounds Per Acre		
		Nitrogen	Seed Cotton	
			Yield	Increase
No nitrogen	0	0	1757.7	....
March 3	4	.........*	1941.3	183.6
March 16	10	109.2	1869.3	111.6
April 3	24	130.0	1802.7	45.0
April 10—Mature	34	148.5	1826.1	68.4
30 lbs. nitrogen	0	30.0	1897.2	139.5

*Indications were that 50-100 pounds of nitrogen was added at this stage of growth.

TABLE 2—ABOVE GROUND NITROGEN PER ACRE AND OTHER DATA FOR SIX DATES OF SEEDING HAIRY VETCH, HUNGARIAN VETCH, AND AUSTRIAN PEAS

	Annual									Average		
	1933			1934			1935			1933-35		
Winter Legume	Date Planted	Inches Growth	Lbs. N. per Acre	Date Planted	Inches Growth	Lbs. N. per Acre	Date Planted	Inches Growth	Lbs. N per Acre	Date Planted	Inches Growth	Lbs. N. per Acre
	Turned April 19, 1933			Turned April 11, 1934			Turned April 15, 1935			Turned April 15, 1933-35		
Hairy Vetch	....	....	....	Sept. 20	36	195.9	Sept. 15	30	156.7	Sept. 17	33*	176.3*
Hairy Vetch	Oct. 1	36	157.5	Oct. 3	36	213.4	Oct. 1	32	149.1	Oct. 1	35	173.3
Hairy Vetch	Oct. 19	36	96.9	Oct. 16	32	165.6	Oct. 15	24	121.5	Oct. 17	31	128.0
Hairy Vetch	Nov. 2	36	67.6	Nov. 1	30	113.9	Nov. 1	20	63.3	Nov. 1	29	81.6
Hairy Vetch	Nov. 16	36	67.5	Nov. 16	22	74.4	Nov. 15	8	65.9	Nov. 16	22	69.3
Hairy Vetch	Dec. 1	36	77.5	Dec. 1	18	73.1	....	....	....	Dec. 1	27**	75.3**
Hungarian Vetch	....	....	....	Sept. 20	36	177.6	Sept. 15	24	120.6	Sept. 17	30*	149.1*
Hungarian Vetch	Oct. 1	30	193.9	Oct. 3	36	183.8	Oct. 1	24	138.8	Oct. 1	30	172.2
Hungarian Vetch	Oct. 19	30	125.5	Oct. 16	30	180.3	Oct. 15	24	99.1	Oct. 17	28	135.0
Hungarian Vetch	Nov. 2	30	95.1	Nov. 1	24	108.8	Nov. 1	18	99.1	Nov. 1	24	101.0
Hungarian Vetch	Nov. 16	30	75.1	Nov. 16	16	92.7	Nov. 15	8	87.2	Nov. 16	18	85.0
Hungarian Vetch	Dec. 1	30	111.8	Dec. 1	12	82.9	....	....	....	Dec. 1	21**	97.4**
Austrian Peas	....	....	....	Sept. 20	30	164.4	Sept. 15	24	116.7	Sept. 17	27*	140.6*
Austrian Peas	Oct. 1	Winter killed		Oct. 3	30	134.7	Oct. 1	24	91.8	Oct. 1	18	75.5
Austrian Peas	Oct. 19	30	82.2	Oct. 16	24	120.1	Oct. 15	24	100.7	Oct. 17	26	101.0
Austrian Peas	Nov. 2	30	50.4	Nov. 1	22	117.1	Nov. 1	18	110.1	Nov. 1	23	92.5
Austrian Peas	Nov. 16	30	50.9	Nov. 16	16	71.5	Nov. 15	8	85.3	Nov. 16	18	69.2
Austrian Peas	Dec. 1	30	76.9	Dec. 1	14	48.0	....	....	....	Dec. 1	22**	62.5**

*Only 2-year averages, 1934-35.

**Only 2-year averages, 1933-34.

Cost of Winter Legumes Under Delta Conditions: Seed, Inoculation, Seeding, Plowing Under

The cost of an acre of winter legumes varies in different sections of the country and with different legume crops and method of planting and handling. The calculated cost of an acre of hairy vetch as commonly handled in the Delta is presented in table 5. Bur clover harvested on the plantation would cost much less.

These calculations show that an acre of hairy vetch nitrogen costs approximately $3.61, which is very close to the cost of fertilizing an acre of land with 30 pounds of commercial nitrogen in the Delta. On land where legumes will not make a good growth without lime and phosphorus, 500 pounds of basic slag per acre can be applied once every three years at an added annual cost of about $1.00 per acre, which will make the cost of an acre of winter legumes on this land cost approximately $4.61. Cheaper seed of other legumes would cost correspondingly less.

TABLE 5—CALCULATED PER ACRE COST OF HAIRY VETCH NITROGEN FOR COTTON PRODUCTION IN THE DELTA OF MISSISSIPPI

	Per Acre		
Item	Cash Cost	Non-Cash Cost	Total Cost
Seed and inoculation	$2.70	.....	$2.70
Man labor for planting	......	$.20	.20
Mule labor for planting	......	.20	.20
Implement and machinery charge		.10	.10
Extra work for plowing under	......	.41	.41
Total	......	.....	$3.61*

*Increased yields per acre from hairy vetch on the Delta Experiment Station were equivalent to an average of 55 pounds of commercial nitrogen over a 10-year period. This amount of commercial nitrogen ordinarily costs from $4.00 to $6.00 per acre.

Foreground—California Bur Clover. Background—Abruzzi Rye in Cotton Cover Crops Test. Photographed just before turning under on April 6

Experiments in Other Areas Indicate Response to Legume Nitrogen Especially Pronounced in West Delta

There is a question in the minds of some research workers as to the value of legume crops for soil building. These workers have studied and analyzed the data obtained throughout the country and are of the opinion that legumes are not as valuable for soil building as was once thought. It seems that legumes do not behave alike in all sections of the country or even throughout the entire state.

According to information published in Mississippi Bulletin 336 (1), legume nitrogen secured from turning under a good crop of winter legumes in the hill sections of Mississippi was apparently equal to 24 pounds of commercial nitrogen in cotton production and 24 to 32 pounds of commercial nitrogen in corn yields. Likewise, according to information published in Alabama Circular 74 (2), vetch or Austrian peas increased cotton yields 628 pounds of seed cotton and corn 15.6 bushels per acre. The increase in cotton yields was worth $3.78 more per acre than the increase from 225 pounds of nitrate of soda, or its equivalent, after considering the cost of the legume seed and the cost of nitrate of soda.

The U. S. Agricultural Technical Bulletin 367 (3) states, "The primary purpose of planting winter legumes in the south is to enrich the land; they are plowed down in the spring to fertilize corn, cotton, and other crops. The secondary use of winter legumes is for hay and grazing and the prevention of soil erosion." This same bulletin shows that on 818 acres in 62 fields in the southeast, hairy vetch increased cotton yields 109 pounds of lint per acre, which was more than the entire production per acre of much land that was being farmed at that time.

It is shown in South Carolina Circular 51 (4) that hairy vetch produced more cotton than other legumes and also more than 30 pounds of commercial nitrogen.

New Jersey Bulletin 609 (5) states, "In many respects green manures are substitutes for farm manure. Vetch produced plant material equal in acre weight to approximately 9.5 tons of fresh farm manure with a normal moisture content of 80 percent. In terms of nitrogen an acre of vetch contained as much as 14.5 tons of farm manure analyzing 0.46 percent nitrogen."

Undoubtedly, all the residual effects of legumes on soils and following crops are not due to their nitrogen-fixing ability alone. The growth habits and nitrogen content of the root system is usually overlooked in appraising the value of legumes to southern agriculture.

New York State Bulletin 596 (6) says, "These two effects of legumes, namely, their distinctive root habits and the effect of their nitrogen content, are quite distinct from their well-known nitrogen-fixing ability and may be overlooked in appraising their comparative value to agriculture." This publication shows that 80.4 percent of red clover root system is between the depth of 10-40 inches, whereas 67.7 per cent of oats root system is between the depth of 1-10 inches. This publication also indicates that probably the incorporation of the easily decomposable organic matter in alfalfa has important effect on soil tilth, aeration and biological and chemical changes in soil constituents, which have been particularly beneficial to the unproductive hill soils of New York.

Since legumes have a deeper root system than most non-legumes, this root penetration possibly has some beneficial effects on the water absorption capacity and plant food availability of soils.

Vetch Crop Turned Under Equal to 55.4 Pounds Commercial Nitrogen at Stoneville, West Delta

Various experiments have been conducted at the Delta Station and in the East Delta Area to determine the soil fertility value of winter legumes in the Yazoo-Mississippi Delta. The first experiment conducted was begun in the Fall of 1929. The purpose of this test was to compare the fertility value of winter legumes and rye with 30 pounds of commercial nitrogen for cotton yields. This experiment was conducted on Sharkey loam soil. All cover crops were planted during the month of October and plowed under during the first half of April and cotton planted around the first of May annually.

Table 6 presents the annual and average yields of cotton with no nitrogen, the annual and average increase or decrease due to winter legumes, rye, and commercial nitrogen, respectively, and the number of pounds of commercial nitrogen hairy vetch was equivalent to during a 10-year period.

These data show that legume crops failed to increase cotton yields in 1930, which could be partially attributed to a very severe winter in 1929-30 which left only half a stand of legumes, and an extremely dry summer in 1930. Austrian peas were as productive as hairy vetch the first four years but failed to increase cotton yields equivalent to hairy vetch the last six years. The greatest increase from hairy vetch was obtained the tenth year, whereas yields from Austrian peas tended to decrease the last five. Every year except 1930 the increased yield from hairy vetch was equal to more than 30 pounds of commercial nitrogen. A 10-year average shows hairy vetch to be equal to 55.4 pounds of commercial nitrogen. The turning under of rye decreased yields every year during the 10-year period.

During the period of 1933-1939, annual yellow sweet clover (Melilotus indica) and California bur clover were included in this 10-year test. Table 7 presents data indicating the annual and average amount of green and dry crops and nitrogen turned under as well as the following cotton yields.

These results indicate that California bur clover added more plant growth and nitrogen to the soil, but hairy vetch increased cotton yields the most. Figures for the seven-year average show that all legumes increased cotton yields considerably more

TABLE 6—THE INFLUENCE OF WINTER LEGUMES, RYE, AND COMMERCIAL NITROGEN ON COTTON YIELDS, AND THE EQUIVALENT POUNDS OF COMMERCIAL NITROGEN FROM HAIRY VETCH OVER A 10-YEAR PERIOD—1930-39

	Pounds of Seed Cotton per Acre					Hairy Vetch Equivalent to Pounds of Nitrogen
	Total Yield	Increased Yield From				
Year	No Nitrogen	30 lbs. Commercial Nitrogen	Austrian Peas	Hairy Vetch	Abruzzi Rye	
1930	892.5	174.4	—133.3	—99.1	—184.6	—17.1
1931	708.6	129.8	239.3	156.9	—62.5	36.2
1932	670.3	18.7	136.3	122.3	—192.0	196.3
1933	1262.5	496.1	528.8	519.7	—116.0	31.4
1934	982.1	381.1	769.2	828.5	—108.7	65.2
1935	1267.2	265.2	650.2	1003.5	—226.6	113.5
1936	833.5	128.6	292.5	440.9	—170.1	102.8
1937	1106.4	428.4	503.1	806.1	—211.1	56.4
1938	766.6	264.1	227.1	392.2	—38.2	44.6
1939	941.0	577.8	488.7	1097.3	—198.4	57.0
1930-39 (Av.)	943.1	286.4	370.2	526.8	—150.8	55.2

TABLE 7—AMOUNT OF WINTER LEGUME AND NITROGEN TURNED UNDER AND SUBSEQUENT COTTON YIELDS OVER A PERIOD OF 7 YEARS

Treatments	Annual							Av.
	1933	1934	1935	1936	1937	1938	1939	1933-39
	Pounds per Acre Turned Under When Green							
Austrian Peas	23658	17315	15355	14201	13561	3387	8166	13663
Hairy Vetch	29403	17729	14876	9322	23609	19041	11811	17970
Melilotus Indica	*5880	4530	11543	17904	21954	7251	9819	11268
Cal Bur Clover	*6534	17969	32626	27603	31871	20897	29998	23928
	Pounds per Acre Turned Under When Dry							
Austrian Peas	2069	3376	2897	2135	2323	595	1472	2124
Hairy Vetch	2962	3267	2984	1423	3499	2889	1835	2694
Melilotus Indica	*696	849	2113	2701	3847	1321	1863	1913
Cal. Bur Clover	*1023	3398	4988	4821	4544	2977	4270	3717
	Pounds of Nitrogen per Acre Turned Under							
Austrian Peas	50.3	111.7	83.1	66.8	61.8	17.9	35.3	61.0
Hairy Vetch	74.9	104.2	100.6	50.8	93.8	97.1	68.6	84.3
Melilotus Indica	*23.2	29.6	68.5	73.7	95.8	37.0	51.7	54.2
Cal. Bur Clover	*35.5	133.2	168.6	123.4	110.4	88.4	115.3	110.7
	Pounds of Seed Cotton per Acre Harvested							
No Nitrogen	1263	982	1267	834	1106	767	941	1023
30 lbs. Commercial Nit.	1759	1363	1532	962	1535	1031	1519	1386
Austrian Peas	1791	1751	1917	1126	1610	994	1430	1517
Hairy Vetch	1782	1811	2271	1274	1913	1159	2038	1750
Melilotus Indica	1442	1311	1703	1073	1669	1157	1651	1429
Cal Bur Clover	1355	1385	1996	1142	1488	1275	1978	1517

*Poor stand caused by water and freeze in 1933.

TABLE 8—WINTER LEGUMES, CONTINUOUSLY AND AT VARIOUS INTERVALS, FOR COTTON PRODUCTION

Treatments	Pounds of Seed Cotton per Acre						
	Annual Yields					Average	
	1935	1936	1937	1938	1939	Yield	Increase
No Nitrogen every year	886.8	852.6	1248.6	924.6	926.8	967.9	....
30 lbs. Nitrogen every year	1054.8	1113.8	1587.9	1112.7	1437.7	1261.4	293.5
Winter Legumes every year	1242.2	1086.5	1575.9	842.5	1889.1	1327.2	359.3
Winter Legumes every 2nd year and unfertilized other years	1145.1	907.6	1605.4	968.3	1638.4	1253.0	285.1
Winter Legumes every 2nd year and 30 lbs. N. other years	1138.7	1199.3	1747.3	1148.0	1581.5	1363.0	395.1
Winter Legumes every 3rd year and unfertilized other years	1018.1	1124.3	1293.3	983.2	1066.4	1097.1	129.2
Winter Legumes every 3rd year and 30 lbs. N. other years	953.0	1028.8	1658.9	995.6	1599.4	1247.1	279.2

TABLE 9—RESIDUAL EFFECTS OF WINTER LEGUMES ON COTTON YIELDS

Treatments	Pounds of Seed Cotton per Acre				
	Annual Yields			Average	
	1937	1938	1939	Yield	Increase
No Nitrogen every year	1248.6	924.6	926.8	1033.3	....
30 lbs. of Nitrogen every year	1587.9	1112.7	1437.7	1379.4	346.1
Winter Legumes every year	1575.9	842.5	1889.1	1435.8	402.5
Winter Legumes first year after No Nitrogen one year	1605.4	978.5	1638.4	1407.4	374.1
Winter Legumes first year after No Nitrogen two years	1731.3	983.2	1886.4	1533.6	500.3
No Nitrogen first year after Winter Legumes one year	1357.9	960.1	1066.4	1128.1	94.8
No Nitrogen second year after Winter Legumes one year	1293.3	838.5	1109.8	1080.5	47.2

Harvesting Giant Bur Clover Seed by Hand in the Yazoo-Mississippi Delta

than 30 pounds of commercial nitrogen. Austrian peas were severely damaged by diseases in 1938 and 1939.

A good crop of winter legumes adds approximately twice as much nitrogen as a cotton crop can utilize in one year. Apparently, there is a loss of nitrogen when legumes are planted continuously on the same land or else there would be a nitrogen build-up that might be sufficient for several years. With these ideas in mind, an experiment was begun in 1935 in an effort to determine how often winter legumes should be planted for maximum cotton yields and also to compare rotations of winter legumes and commercial nitrogen with each alone. This experiment was conducted on Sharkey loam soil. Austrian peas were used as the winter legume the first four years and hairy vetch the fifth year and thereafter. The legume was planted in October, plowed under the first half of April, and cotton planted around the first of May. Table 8 presents the yields of seed cotton from winter legumes grown at different yearly intervals, compared with yields from no nitrogen and 30 pounds of commercial nitrogen annually.

In 1938 Austrian peas were damaged by diseases and failed to increase cotton yields as winter legume crops usually do. These results indicate that winter legumes progressively increased cotton yields more than did 30 pounds of nitrogen for the five-year average. Winter legumes planted alternate years increased yields just slightly less than 30 pounds of nitrogen annually for the five-year period. The alternate rotation of winter legume and commercial nitrogen produced slightly better average yields for the five-year period.

In table 9 is shown the value of winter legumes on land that has been without legumes and commercial nitrogen for one and two years and the carry-over value for one and two years after the legumes have been grown and no commercial nitrogen used.

These results also show that legumes

planted every year increased cotton yields more than did 30 pounds of commercial nitrogen. Greater responses were obtained from winter legumes planted on land that had no nitrogen for two years. A three-year average increase of 94.8 pounds of seed cotton per acre was obtained the first year after legumes were discontinued and 47.2 pounds the second year. Data in tables 8 and 9 indicate that the beneficial results obtained from winter legumes last more than one year.

Returns from Winter Legumes Slightly Less in Outlying Tests, Located in East Delta Area

Information showing the value of winter legumes has been obtained in three outlying fields during the past four years, one other field the past three years and another the past two years on the east side of the Delta where the soils are more acid and are usually deficient in nitrogen, potash, and phosphorus.

Schaefer Field

Winter legumes had been grown previously with very favorable results on the Schaefer field, which is located on typical Yazoo basin fine sandy loam soil on the west side of the Yazoo River, three miles west of Yazoo City, Mississippi. These soils are acid to the extent that limestone has to be applied for successful alfalfa production. These soils also respond favorably to potash and phosphorus in cotton yields; however, bur clover, hairy vetch, and Austrian peas grow well without the addition of lime, potash, or phosphorus.

In table 10 are presented the yields of seed cotton for all treatments and the amount of commercial nitrogen hairy vetch has equaled for the past four years on this field.

This information suggests that unfavorable results were obtained from all winter

Disking Under Austrian Peas on a Yazoo-Mississippi Delta Plantation

TABLE 10—WINTER LEGUMES FOR COTTON PRODUCTION—SCHAEFER FIELD—YAZOO CITY, MISSISSIPPI

Treatments	Pounds of Seed Cotton per Acre					
	Annual Yield				4-year Average	
	1936	1937	1938	1939	Yield	Increase
No Nitrogen	1327.8	1621.0	1277.2	1084.2	1327.6	....
Sodium Nitrate	1531.5	1933.2	1824.3	1522.8	1703.0	375.4
Austrian Peas	1254.7	2020.5	1949.7	1451.5	1669.1	341.5
Hairy Vetch	1270.9	2055.3	2047.4	1642.2	1754.0	426.4
Hungarian Vetch	1253.3	1931.4	1843.3	1408.8	1609.2	281.6
California Bur Clover	1251.4	2089.3	1854.6	1680.1	1718.9	391.3
Giant Bur Clover*	1266.8	2109.3	1741.9	1467.5	1646.4	318.8
Hairy Vetch equivalent to lbs. of Nitrogen	—8.38	41.72	42.23	38.17	34.08	....

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields. As ordinarily handled under plantation conditions, excellent results are obtained from giant bur clover on this type of land.

TABLE 11—WINTER LEGUMES FOR COTTON PRODUTION—ATKINSON FIELD—VALLEY, MISSISSIPPI

Treatments	Pounds of Seed Cotton per Acre					
	Annual Yield				4-year Average	
	1936	1937	1938	1939	Yield	Increase
No Nitrogen	1269.2	951.2	1097.2	828.3	1036.5	....
Sodium Nitrate	1452.2	1186.2	1330.7	1305.0	1318.5	282.0
Austrian Peas	1287.1	1277.8	1365.2	1394.9	1331.3	294.8
Hairy Vetch	1240.0	1357.9	1297.6	1502.8	1349.6	313.1
Hungarian Vetch	1261.9	1191.7	1274.2	1192.1	1230.0	193.5
California Bur Clover	1266.9	1258.2	1202.7	703.7*	1107.9	71.4
Giant Bur Clover**	1389.6	1162.1	1085.4	1336.6	1243.4	206.9
Hairy Vetch equivalent to lbs. of Nitrogen	—4.79	51.94	25.76	42.45	33.31	....

*Approximately one-half stand of cotton obtained after turning under a tremendous crop of clover.

**Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields.

legumes the first year; but since the first year, hairy vetch and California bur clover have increased cotton yields more than 30 pounds of commercial nitrogen. Even with a decreased yield the first year, hairy vetch was equal to an average of 34.08 pounds of nitrogen for the four-year period. Hungarian vetch did not produce as favorable results as other legumes, because it failed to produce an equal crop.

Atkinson Field

Winter legumes had never been grown on the Atkinson field previous to 1936 and failed to make sufficient growth to produce favorable results that year. This field is located on typical East Delta fine sandy loam soil, one-half mile from the hills and one mile southwest from Valley, Mississippi, which is on the Yazoo City-Vicksburg highway. Apparently, these soils will not produce a good growth of winter legumes without the addition of certain basic materials. This soil responds readily to phosphorus and potash in cotton production. Applications of 500 pounds of basic slag and 100 pounds of muriate of potash per acre were made the second and third years on all treatments, and good growths were obtained from most of the winter legumes. California bur clover seemed to be adapted better to this soil and made more growth than the other legumes. Bad stands of cotton followed, which probably could have been avoided if properly handled, thus holding up the increase in yield.

In table 11 are presented the annual

Austrian Peas Ready for Turning Under in the Winter Legume Test at the Schaefer Field near Yazoo City

TABLE 12—WINTER LEGUMES FOR COTTON PRODUCTION—HEMPHILL FIELD—VALLEY HILL, MISSISSIPPI

	Pounds of Seed Cotton per Acre					
	Annual Yield				4-year Average	
Treatments	1936	1937	1938	1939	Yield	Increase
No Nitrogen	1387.1	824.0	610.3	797.3	904.7	....
Sodium Nitrate	1596.0	1189.2	1059.6	1289.4	1283.6	378.9
Austrian Peas	1469.2	990.4	1237.4	1082.4	1194.9	290.2
Hairy Vetch	1403.3	1120.1	1320.4	1307.4	1287 8	383.1
Hungarian Vetch	1448.6	1023.6	1121.4	1101.7	1173.8	269.1
California Bur Clover	1341.5	895.5	1152.3	1649.3	1259.7	355.0
Giant Bur Clover*	1317.0	955.8	889.6	1463.3	1156.4	251.7
Hairy Vetch equivalent to lbs. of Nitrogen	2.33	24.33	47.40	31.10	30 33	....

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields.

TABLE 13—WINTER LEGUMES FOR COTTON PRODUCTION—LADD FIELD—CHARLESTON, MISS.

	Pounds of Seed Cotton per Acre				
	Annual Yields			3-year Average	
Treatments	1937	1938	1939	Yield	Increase
No Nitrogen	1281.4	1196.2	1224.8	1234.1	....
Sodium Nitrate	1724.9	1765.4	1763.1	1751.1	517.0
Austrian Peas	1257.7	1374.9	1243.0	1291.9	57.8
Hairy Vetch	1454.4	1979.5	1654.6	1696.2	462.1
Hungarian Vetch	1444.4	1398.9	1439.5	1427.6	193.5
California Bur Clover	1659.9	1409.0	1585.8	1551.6	317.5
Giant Bur Clover*	1253.7	1345.1	1500.3	1366.4	132.3
Hairy Vetch equivalent to lbs. of Nitrogen	11.71	41.29	23.96	26.82	....

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields.

Left to Right—Cotton Following No Nitrogen, and California Bur Clover in a Cotton Cover Crops Test on the Delta Station. Photographed early in August

and average yields of all treatments and the number of pounds of nitrogen which hairy vetch has equaled.

In this experiment winter legumes failed to produce favorable results the first year; but hairy vetch and Austrian peas, for an average of four years, increased yields more than 30 pounds of commercial nitrogen. Even with a decreased yield the first year, hairy vetch was equal to 33.31 pounds of nitrogen during the four-year period. Since California bur clover makes better growth on this soil, possibly it could be used under plantation conditions with very favorable results.

A five-acre block of either Austrian peas or hairy vetch was planted each year under plantation conditions across the turnrow, and except the first year, excellent growth was produced.

Hemphill Field

Winter legumes had never been grown on the Hemphill field previous to 1936, which is located on a loamy sand soil about half a mile from the hills and six miles east of Greenwood, Mississippi. This soil probably has more sand in it than the average East Delta soil, and cotton has not responded very favorably to applications of phosphorus and potash.

Very little winter legume growth resulted the first year. Applications of 500 pounds of basic slag and 100 pounds of muriate of potash per acre were made on all treatments in 1937 and 1938, and fair legume crops followed. California bur clover seemed to be better adapted to this land than the other legumes; however, hairy vetch made the highest four-year average yield of seed cotton. The results are shown in table 12.

The results of this test show that winter legumes produced very small increases of seed cotton the first year. However, this poor growth did not decrease cotton yields the first year. Hairy vetch and Austrian peas more than doubled cotton yields the third year. The four-year average yields show that hairy vetch again produced more cotton than 30 pounds of commercial nitrogen. The fourth year California bur clover more than doubled cotton yields.

Throughout these tests winter legumes planted broadcast and left flat on this type of land gave best results.

A cotton variety test in this field just across a turnrow has been seeded broadcast with either vetch or Austrian peas for the past four years at 50 to 75 pounds of seed per acre, disked in, and left flat. Good cover crop growth has been obtained every year, whereas the same legume crops failed to make satisfactory growth when planted and left on the side or top of the bed. For the past two years, seed in the regular legume test were broadcast and scratched in with a cultivator, which resulted in fair crops.

Ladd Field

Winter legumes had never been grown on this field before 1937. This is typical East Delta fine sandy loam soil, and the field is located about one-half mile from the hills and three miles southwest of Charleston, Mississippi. There is a distinct deficiency of nitrogen and potash and a slight need for phosphorus in this soil. This land has a heavy infestation of Johnson grass and other obnoxious weeds which interfered with obtaining stands of winter legumes on the small plats in the winter legume test. California bur clover is the only legume that came up to a good stand and grew a good crop each year

In 1938, 500 pounds of basic slag and 100 pounds of muriate of potash per acre was applied to all treatments, which resulted in a good crop of hairy vetch.

Table 13 shows the results of this experiment for a period of three years.

This is the only test conducted in the Delta in which hairy vetch failed to produce more cotton than 30 pounds of commercial nitrogen over a period of years; nevertheless, marked increases were

Harvesting Giant Bur Clover With an Improvised Vacuum Machine in the Yazoo-Mississippi Delta

TABLE 14—WINTER LEGUMES FOR COTTON PRODUCTION—SMITH FIELD—WEBB, MISSISSIPPI

Treatments	Pounds of Seed Cotton per Acre			
	Annual Yields		2-year Average	
	1938	1939	Yield	Increase
No Nitrogen	856.6	817.6	837.1	....
Sodium Nitrate	1186.8	1339.8	1263.3	426.2
Austrian Peas	1167.0	1218.2	1192.6	355.5
Hairy Vetch	1389.8	1573.7	1481.8	644.7
Hungarian Vetch	1036.6	1209.5	1123.1	286.0
California Bur Clover	1009.6	757.5	883.6	46.5
Giant Bur Clover*	840.0	1018.3	929.2	92.1
Hairy Vetch equivalent to lbs. of Nitrogen	48.43	43.43	45.37	....

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields. As ordinarily handled under plantation conditions, excellent results are obtained from giant bur clover on this type of land.

obtained following each legume. Observations indicate that better results would have been obtained on plantings of a larger acreage of either hairy vetch or California bur clover with sufficient fall preparation to prevent weeds, thus obtaining better stands earlier in the fall. A three-acre block of vetch or Austrian peas was planted each year in the same field under plantation conditions and produced a fair growth.

Smith Field

This field is located on typical sandy loam soil in the Coldwater-Tallahatchie River basin four miles south of Webb, Mississippi. This soil responds well to nitrogen but only slightly to potash and phosphorus. Winter legumes grow well if the soil is drained sufficiently to prevent standing water.

A legume test was grown in this field in 1937, but insufficient surface drainage

TABLE 15—AVERAGE YIELDS, COST, AND VALUE OF WINTER LEGUMES FOR 17 TESTS IN 5 FIELDS DURING THE PAST 4 YEARS

Treatments	Lbs. Seed Cotton per Acre		Value Increase at 3c per lb.	Cost of Nitrogen or Seed per A.	Net Value of Increase	Net Value per lb. of Seed or Nitrogen
	Yield	Increase				
No Nitrogen	1085.4	....	....	......	......	....
30 lbs. Commercial Nitrogen	1470.6	385.2	$11.56	$3.15	$8.41	$.28
Austrian Peas	1355.4	270.0	8.10	1.93	6.17	.18
Hairy Vetch	1506.9	421.5	12.65	2.63	10.02	.40
Hungarian Vetch	1328.3	242.9	7.29	1.80	5.49	.18
California Bur Clover	1339.3	253.9	7.62	2.25	5.37	.36
Giant Bur Clover*						

*The average data for giant bur clover was omitted, because the cost of seeding and results obtained in this work is out of line with the common plantation system of handling this clover.

TABLE 17—THE INFLUENCE OF COMMERCIAL NITROGEN ON COTTON FOLLOWING HAIRY VETCH ON BUCKSHOT SOIL

Treatments	Pounds of Seed Cotton per Acre						
	Annual Yields					Average	
	1935	1936	1937	1938	1939	Yield	Increase
No Nitrogen	1579.7	1725.5	1648.1	796.8	1482.1	1446.4	....
Winter Legume Alone	1613.2	1976.9	2101.8	1331.2	2062.0	1817.0	370.6
Winter Legume and 30 lbs. of Nitrogen	1881.9	2078.3	2183.7	1180.8	2127.5	1890.4	444.0
80 lbs. of Nitrogen Alone	2048.3	2162.9	1864.5	959.6	1936.3	1794.3	347.9

TABLE 16—NITROGENOUS FERTILIZERS ON COTTON AFTER BUILDING UP LAND WITH SUMMER AND WINTER LEGUMES

Treatment	Pounds of Seed Cotton per Acre										
	Annual Yields									Average	
	1931	1932	1933	1934	1935	1936	1937	1938	1939	Yield	Increase
Corn and Soybeans on Land, 1926-27-28-29-30 and 1934-35-36 Winter Legumes and Sources of Nitrogen at 30 lbs. Nitrogen per Acre on Cotton, 1931-32-33 and 1937-38-39											
Winter Legumes Alone	1833.1	957.8	2139.7	....	....	....	2281.5	1952.8	1990.6	1859.3	....
Sodium Nitrate Plus Winter Legumes	1961.2	1043.1	2381.6	....	....	....	2377.8	2055.6	1984.7	1967.3	108.0
Calcium Nitrate Plus Winter Legumes	1938.7	1047.4	2460.1	....	....	....	2446.8	2091.7	2078.8	2010.6	151.3
Ammonium Sulphate Plus Winter Legumes	1812.3	1005.9	2344.0	....	....	....	2390.6	2067.8	2078.0	1949.8	90.5
Cyanamid Plus Winter Legumes	1977.0	996.7	2438.3	....	....	....	2473.5	2101.5	2188.4	2029.2	169.9
Corn and Soybeans on Land, 1931-32-33 and Since Winter Legumes and Sources of Nitrogen at 30 lbs. Nitrogen per Acre on Cotton, 1934-35-36											
Winter Legumes Alone	....	....	....	1404.0	1327.7	698.0	....	....	....	1143.2	....
Sodium Nitrate Plus Winter Legumes	....	....	....	1417.8	1314.9	653.5	....	....	....	1128.7	—14.5
Calcium Nitrate Plus Winter Legumes	....	....	....	1366.1	1245.5	700.1	....	....	....	1103.9	—39.3
Ammonium Sulphate Plus Winter Legumes	....	....	....	1458.5	1275.3	691.8	....	....	....	1141.9	—1.3
Cyanamid Plus Winter Legumes	....	....	....	1376.0	1366.6	628.8	....	....	....	1123.8	—19.4
Corn and Soybeans on Land, 1926-27-28-29-30 and 1934-35-36 Winter Legumes and Rates of Applying Cyanamid on Cotton, 1931-32-33 and 1937											
Winter Legumes Alone	1904.6	817.2	2168.2	....	....	....	2386.8	....	....	1819.2	....
34 lbs. Cyanamid Plus Winter Legumes	1958.1	828.4	2329.8	....	....	....	2485.2	....	....	1900.4	81.2
68 lbs. Cyanamid Plus Winter Legumes	1943.7	867.3	2411.2	....	....	....	2388.1	....	....	1902.6	83.4
102 lbs. Cyanamid Plus Winter Legumes	1993.6	889.6	2371.3	....	....	....	2518.1	....	....	1943.2	124.0
136 lbs. Cyanamid Plus Winter Legumes	1939.5	897.8	2450.8	....	....	....	2422.4	....	....	1927.6	108.4
170 lbs. Cyanamid Plus Winter Legumes	1916.1	849.7	2521.3	....	....	....	2402.1	....	....	1922.3	103.1
205 lbs. Cyanamid Plus Winter Legumes	2025.6	901.0	2575.8	....	....	....	2430.7	....	....	1983.3	164.1
Corn and Soybeans on Land, 1931-32-33 and Since Winter Legumes and Rates of Applying Cyanamid on Cotton, 1934-35-36											
Winter Legumes Alone	....	....	....	1227.6	975.6	577.8	....	....	....	927.0	....
34 lbs. Cyanamid Plus Winter Legumes	....	....	....	1212.6	881.1	617.0	....	....	....	903.6	—23.4
68 lbs. Cyanamid Plus Winter Legumes	....	....	....	1199.4	970.8	664.1	....	....	....	944.8	17.8
102 lbs. Cyanamid Plus Winter Legumes	....	....	....	1205.6	852.6	569.1	....	....	....	875.8	—51.2
136 lbs. Cyanamid Plus Winter Legumes	....	....	....	1338.7	1066.1	609.4	....	....	....	1004.7	77.7
170 lbs. Cyanamid Plus Winter Legumes	....	....	....	1338.7	1070.7	656.6	....	....	....	1022.0	95.0
205 lbs. Cyanamid Plus Winter Legumes	....	....	....	1342.4	1204.3	659.7	....	....	....	1068.8	141.8

damaged the legume crops to such an extent that cotton yields were not recorded. Cotton yields were recorded on three of the six well-drained replications in 1938 and 1939.

Two-year results for this field are presented in table 14.

These results indicate that winter legumes can be grown successfully on this type of soil. Unquestionably, hairy vetch was the best winter legume crop grown in this field for the past two years. Probably the poor results obtained from giant bur clover were due to the method and lateness of planting, since ordinarily, bur clover produces favorable results in this area under plantation conditions. Hairy vetch increased cotton yields equal to 45.37 pounds of commercial nitrogen during the two-year period. The low cotton yields following California bur clover in 1939 resulted from approximately one-half stand of cotton.

Average All Five Fields

Results from these five outlying fields on the east side of the Delta vary slightly, but in general there was less response from winter legumes than in the west part of the Delta.

Average results for the five fields for all years are presented in table 15

These data indicate that with proper management winter legumes can be grown successfully producing a worthwhile profit in increased cotton yields even on the East Delta soils which have less lime phosphorus, and potash than West Delta soils.

Again hairy vetch increased cotton yields more than 30 pounds of commercial nitrogen or other legumes used. The average increase due to hairy vetch was equal to 33.93 pounds of commercial nitrogen. After deducting the cost of winter legume seed at 4c to 10.5c per pound there was a profit of 18c to 40c per pound obtained from the seed. The commercial nitrogen cost about 10.5c per pound and returned a profit of 28c for each pound used. The profit per pound of hairy vetch seed used was 40c.

Fertilizing Cotton After Winter Legumes of Doubtful Value, Except on Most Fertile Soils

Since average Delta cotton crops usually utilize 30 pounds to 50 pounds of nitrogen per acre for maximum yields, it is logical to assume that it is not necessary to apply commercial nitrogen to cotton after turning under a winter legume crop containing 75 to 150 pounds of nitrogen per acre. Ordinarily, it is not necessary to fertilize cotton following a good crop of winter legumes in most parts of the Delta, but results showing the indications of a need of more nitrogen under certain conditions have been observed. Possibly the requirements of 30-50 pounds of nitrogen per acre are increased as the humus level is raised following legumes, which raises the maximum production each succeeding year. Experimental results have been obtained in several locations with and without the use of commercial nitrogen and other fertilizers on cotton following winter legumes.

An experiment was made comparing different sources of nitrogen on cotton production following legume crops. The test was continued at the Delta Station during the nine-year period of 1931-39. An adjoining test comparing different rates of nitrogen from cyanamid for cotton production was conducted during the seven-year period of 1931-37. These experiments were begun in 1931 on Sarpy loam soil on which corn and soybeans had been grown from three to five years previously. Cotton and winter legumes were grown on this land for three years, then alternated with corn and soybeans every three years.

Results of these experiments on both fields are shown in table 16.

First Year Volunteer Crop of Giant Bur Clover on the Delta Experiment Station

The yield data show that where soil conditions were such that cotton yields were only a bale per acre or less, the addition of extra nitrogen after turning under winter legumes did not increase the yields as much as where conditions were favorable for the production of a bale or more per acre. The nine and seven-year averages on both types of land show increased yields too low to make it worthwhile to use commercial nitrogen on cotton following one or more good winter legume crops. The results from this test signify that the plats receiving the most legume crops produced the highest cotton yields. The cotton response to commercial nitrogen was also in proportion to the conditioning or improvement due to previous legume crops.

In 1936 another experiment was begun to measure the value of fertilizing cotton following hairy vetch. This test was conducted at this Station on a Sharkey clay soil commonly called "buckshot" land.

The results of this work are presented in table 17.

These data show that over a period of four years 30 pounds of commercial nitrogen applied to cotton following winter legumes on buckshot soil failed to increase cotton yields sufficiently to pay the cost of the fertilizer. Hairy vetch alone increased cotton yields more than did 30 pounds of commercial nitrogen.

Another test was started in 1939, on the Robertshaw plantation at Heathman, Mississippi, to measure the value of applying different amounts of commercial nitrogen to cotton following winter legumes. The soil in this field is of a light ridge land type and considerably different from that of the two previous experiments conducted on the Delta Station.

This experiment was begun on land on which Austrian peas had been grown for several years. Austrian peas were continued as the legume and sodium nitrate as the source of nitrogen.

The results of one year's work are shown in table 18.

TABLE 18—WINTER LEGUME PLUS COMMERCIAL NITROGEN FOR COTTON—HEATHMAN FIELD

Treatments	Pounds of Seed Cotton per Acre 1939 Yield	Increase
No Nitrogen	1571.0	....
30 lbs. Commercial Nitrogen	1746.3	175.3
Austrian Peas	1549.0	—22.0
Austrian Peas and 10 lbs. Nitrogen	1709.6	138.6
Austrian Peas and 20 lbs. Nitrogen	1907.0	336.0
Austrian Peas and 30 lbs. Nitrogen	1857.8	286.8
Austrian Peas and 40 lbs. Nitrogen	1840.4	269.4

These results show that the soil contained sufficient plant food to produce a bale of cotton per acre without a winter legume or commercial nitrogen. Commercial nitrogen at 30 pounds per acre increased the yield only 175.3 pounds of seed cotton. Austrian peas alone in 1939 failed to increase yields, but commercial nitrogen alone did. Therefore, increases obtained from the various rates of commercial nitrogen with the winter legumes are not contrary to expectations. Maximum increases were obtained from 20 pounds of commercial nitrogen when ap-

TABLE 19—FERTILIZING COTTON AFTER BUR CLOVER—EAST DELTA—GARY FIELD—MONEY, MISSISSIPPI—ONE YEAR—1939 ONLY

Treatments	Lbs. Seed Cotton per Acre Yield	Increase	Value Increase at 3c per lb. $	Cost of Fertilizer $	Profit $
Bur Clover Alone	1857.6	....	....	......	....
Bur Clover Plus Nitrogen	2071.6	214.0	6.42	3.30	3.12
Bur Clover Plus Phosphorus	2246.4	388.8	11.66	1.50	10.16
Bur Clover Plus Potash	1846.8	—10.8	—.32	1.30	—1.62
Bur Clover Plus Phosphorus and Potash	1938.4	80.8	2.42	2.80	—.38
Bur Clover Plus Phosphorus, Potash and Nitrogen	2387.7	530.1	15.90	6.10	9.80
Bur Clover Plus Lime	1988.1	130.5	3.92	2.70	1.22

Cotton 5½ Feet High Following Austrian Peas in a Winter Legumes Test—Delta Branch Station plied following a good crop of Austrian peas on this type of soil. One year's results are not conclusive and may change considerably in subsequent years.

Another test was conducted in 1939 with different fertilizer materials applied to cotton following a good bur clover crop on the Wildwood plantation near Money, Mississippi. This test was located on fine sandy loam soil near the east bank of the Tallahatchie River. These soils are deficient in nitrogen and respond fairly well to phosphorus and potash when applied to cotton. Winter legumes, as a rule, make excellent growth without the addition of fertilizers.

A good crop of bur clover was plowed under in the Spring of 1939 and the fertilizers applied on top of the cotton beds and harrowed in before the cotton was planted.

This one year's results are shown in table 19.

Bur clover alone produced 1857.6 pounds of seed cotton per acre, and the addition of 30 pounds of commercial nitrogen increased that yield 214 pounds of seed cotton per acre, 30 pounds of phosphorus 388.8 pounds, and 30 pounds of potash failed to increase the yield. When potash was combined with phosphorus, the increase was 80.8 pounds, and when a complete fertilizer consisting of 30 pounds of each element was applied, the increase was 530.1 pounds of seed cotton per acre. Commercial hydrated lime applied at the rate of 300 pounds per acre increased the yield 130.5 pounds of seed cotton.

After deducting the cost, phosphorus showed a profit of $10.16 per acre. It should be emphasized that this is a one-year result, and should not be considered as indicative unless confirmed by similar returns as the experiment is continued. The lime would have cost less in the form of ground limestone, but these yields were obtained with hydrated lime and might have been different with limestone; therefore, the calculations were based on the cost of the material used.

Left to Right: Hairy and Hungarian Vetch in the Winter Legume Test at the Schaefer Field Near Yazoo City

Nitrogen, phosphorus, and lime increased the yields in 1939 sufficiently to show worthwhile profits, but potash decreased the income in both cases.

Summer Legumes Interplanted With Corn Increase Yields of Succeeding Corn, Cotton Crops

Since decomposition takes place rapidly in the south, it would appear that very little beneficial results could be expected from turning under a crop of soybeans or other summer legumes for soil improvements. Nevertheless, there is a sufficient nitrogen carry-over when a crop of summer legumes are turned under in the Delta area to obtain beneficitl results on the succeeding cotton or corn crop.

According to Florida Bulletin 301 (7), from the first of February to the middle of June, soils on which summer legumes were turned under had a higher nitrate content than soils in which a non-legume, Florida pusley, had been incorporated. Summer legumes in the hills of Mississpipi interplanted with corn had very little effect in soil improvement, according to Mississippi Bulletin 336 (1). Under Delta conditions, however, Mississippi Bulletin 331 (8) presents evidence that soybeans planted in corn at planting time and turned under when mature produced an average of 500 pounds of seed cotton more per acre the following year than corn alone over a period of seven years at the Delta Branch Experiment Station Stoneville, Mississippi.

In 1936 an experiment was begun at the Delta Station to determine the value of soybeans in cotton production on "buckshot" soil.

This information is shown in table 20.

TABLE 20—RESIDUAL EFFECT OF CORN AND SOYBEANS ON COTTON YIELDS ON BUCKSHOT SOIL

Treatments	Pounds of Seed Cotton per Acre					
	Annual Yields				Average	
	1936	1937	1938	1939	Yield	Increase
	4 years—1936-39					
Unfertilized cotton every year	1725.5	1648.1	796.8	1482.1	1413.1	....
Cotton 1st year after corn and soybeans	2098.8	1479.6	1248.3	1494.1	1580.2	167.1
	3 years—1937-39					
Unfertilized cotton every year		1648.1	796.8	1482.1	1309.0	....
Cotton 1st year after corn and soybeans		1479.6	1248.3	1494.1	1407.3	98.3
Cotton 2nd year after corn and soybeans		1962.1	781.7	1749.9	1497.9	188.9

TABLE 21—SUMMER LEGUMES FOR CORN PRODUCTION COMPARED WITH 30 POUNDS OF COMMERICAL NITROGEN AND CORN ALONE*

Treatments	Bushels of Corn per Acre					Value of 1939 Increase 50c bu.	Cost of 1939 Increase	Net Profit from '39 Increase
	Yields			Increases				
	Annual		Average	Annual				
	1938	1939	1938-39	1938	1939			
Corn Alone every year	23.4	12.0	17.7	....	....	....	....	......
Corn with 30 lbs. Nitrogen every year	34.9	29.2	32.1	11.5	17.2	$8.60	$3.40	$5.20
Corn with Soybeans at planting	23.7	26.9	25.3	0.3	14.9	7.45	.40	7.05
Corn with Cowpeas at planting	21.3	25.7	23.5	—2.1	13.7	6.85	.40	6.45
Corn with Crotalaria at planting	25.6	25.0	25.3	2.2	13.0	6.50	.50	6.00
Corn with Soybeans at lay-by	27.2	17.2	22.2	3.8	5.2	2.60	.65	1.95
Corn with Cowpeas at lay-by	27.2	17.4	22.3	3.8	5.4	2.70	.65	2.05
Corn with Crotalaria at lay-by	25.3	16.0	20.7	1.9	4.0	2.00	.75	1.25
2 rows Corn and 2 rows Soybeans	15.3	19.6	17.5	—8.1	7.6	3.80	.50	3.30

*Corn planted first week in May, which was too late for maximum yields from the variety used

A four-year average increased yield of 167.1 pounds of seed cotton was obtained from cotton following corn and soybeans compared with cotton following unfertilized cotton. The three-year average increase was only 98.3 pounds for the first year following corn and soybeans and 188.9 pounds the second year. The three-year average increase indicates better results the second year following corn and soybeans than the first. Evidently, decomposition of the soybeans was not complete the first year, and there was some nitrogen or other beneficial effects carried over the second year following corn and soybeans.

Since moisture is one of the more important factors in corn production, it is reasonable to presume that when water is limited soybeans interplanted with corn would utilize moisture to the extent that corn yields would be reduced, which is apparently the case in other sections of the south.

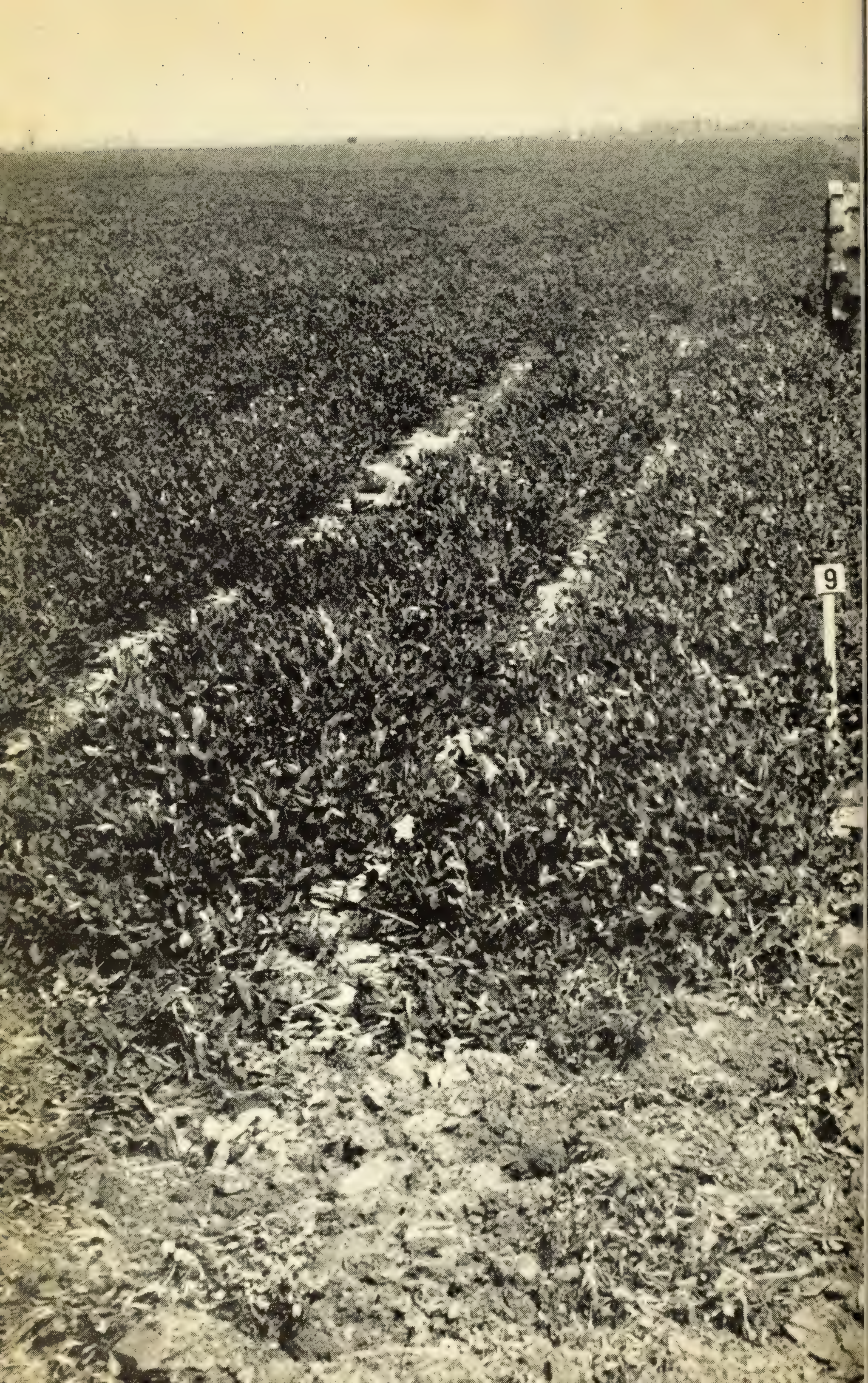
In 1938 an experiment was begun to measure the effects of summer legumes interplanted with corn. Soybeans and cowpeas were planted at the rate of one bushel to five acres, and crotalaria at the rate of five pounds per acre. This test was conducted on Sharkey loam soil and was planted in May each of the two years it has been in progress. Usually April planted corn yields better than that planted in May.

The results of this experiment are shown in table 21.

These results show that soybeans and crotalaria interplanted with corn did not reduce corn yields the first year. These legumes more than doubled corn yields the following year. They failed to increase corn yields equal to 30 pounds of commercial nitrogen the second year, but because of the lower cost of seeding summer legumes, the net profit was greater from the increased yields resulting from summer legumes. The 30 pounds of commercial nitrogen returned a net profit of $5.20 as compared to $7.05 from soybeans interplanted when the corn was planted.

The interplanted soybeans not only increased the corn yields in following crops but according to adjacent yields, eleven bushels of soybeans per acre could have been combined very profitably.

The legumes, when interplanted with corn at lay-by time, made very poor growth both years; therefore, very small increased corn yields were obtained the second year.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Bulletin No. 346 July, 1940

What the Farm Woman Can Do To Improve the Economic Status of Her Family

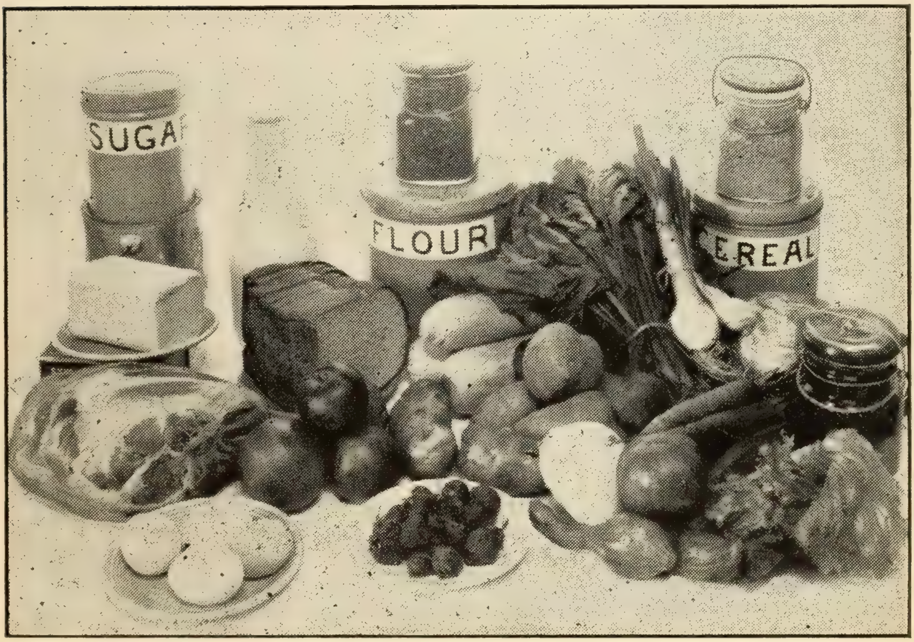

FIGURE 2—FAMILY HEALTH AND EARNING POWER CAN BE IMPROVED ON SUCH A FOOD SUPPLY

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Summary and Conclusions

Many rural women of the State are sparing the farm dollar by good management and labor. When some of the amount thus saved or made is used for improving the farm, the results are a higher income. With higher incomes more is spent for family living, which is productive of better health, better conditions of life, and better opportunities for the children.

Five means whereby farm women of Mississippi are saving and might save the farm dollar are:

(1) **Using time and money efficiently.** Clothing construction and food production as carried on in Mississippi homes are shown to pay by a test based on the amount of money available for family living and the number of working hours. Good money management is also shown to pay, families in which there was good management often getting as much satisfaction from a small amount of money spent on the right sort of things as when twice the amount was thoughtlessly spent by families with larger incomes. Expenditures based on family goals and knowledge of qualities in goods that make them suit their purposes are making good money management possible.

(2) **Improving family health.** Studies by members of the Department show that by providing the family a balanced food supply and by preparing this supply to conserve its food values and by insisting upon certain sanitary precautions, farm women reduce the amount of sickness in their families as well as the expenditures for medical care.

(3) **Acting in the capacity of partner in the farm business.** As partners in the farm business, homemakers of Mississippi are contributing to the farm income and to its money income as well as to its nonmoney income. They are influencing the productive capacity of husband and children both directly and indirectly.

(4) **Engaging in nonagricultural pursuits.** Farm women of Mississippi are to a very limited extent engaging in two types of nonagricultural activities—handicrafts and gainful nonfarm work away from home. The first type of activity is shown especially suitable for the women with children, women nearing middle age or over, and women on out-of-way farms; the second type of activity for young women, whether single, widowed, divorced or married.

(5) **Guiding sons and daughters in such a way that they will make a valuable economic contribution in the future.** Farm homemakers, by instilling habits of work and thrift and by cooperation with public schools, may be the means of assisting their children entering the higher paid occupations when they get out on their own.

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What the Farm Woman Can Do to Improve the Economic Status of Her family

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On a number of occasions and at different times, prosperous farmers have been asked to rank the factors they believe responsible for the prosperity they have attained in farming. In every case the cooperation of their wives is ranked as one of the main factors. This cooperation between husband and wife is very necessary in farming, for the relation of the farm business to that of the farm home is quite close.

Since the farm woman plays such an important role in the success or failure of the farm, it might be well to examine in detail some of her possible contributions. What specifically can she do to improve the economic situation of her family? This bulletin will discuss five things she might do: (1) use time and money efficiently; (2) improve family health; (3) act in the capacity of partner in the farm business; (4) engage in nonagricultural pursuits; and (5) guide sons and daughters in such a way that they will make a valuable economic contribution in the future.

USING TIME AND MONEY EFFICIENTLY

Using time to save money and using money where it will count for most will result in an improvement of family economic status. This has been shown over and over again in farm and household accounts obtained from rural families of Mississippi by members of the Home Economics Department of the Experiment Station. Two of these accounts, those of the Johnson and Brown families, both quite typical of certain classes of farm families in the State, well illustrate this point. (Page 4.)

Mr. Johnson and Mr. Brown are good farmers. Both practice diversified farming, producing for sale livestock and livestock products, truck and fruit, as well as cotton and cottonseed. The Johnsons are buying a place, paying $75 a year on the principal. They have not missed a payment thus far. The Browns rent their farm. It is an exceptionally fine one. These two families are in good health. Both are getting a fairly good diet, although the Johnsons' diet is somewhat better. Their food needs, expressed in food unit costs, are almost identical—6.5 for the Johnson family and 6.4 for the Brown family. Both families bought a radio during the report year, though the Browns paid much more for theirs. Neither had expenditures for housing. Very little furniture and household equipment was purchased. Neither family had work relief. Both had unusual expenditures for medical care; one some expensive dental work, the other a broken arm. Mr. Johnson started a burial policy for the members of his family during the report year; Mr. Brown let his policy lapse. At harvest time Mr. Brown was forced to sell his automobile to pay his debts; Mr Johnson made a $75 payment on his place. What made the difference?

The differences in the expenditures of these two families may be briefly summarized as a difference in:

(1) The extent to which production was carried on in the household. Mrs.

Johnson made practically all the clothing for her family, and with the assistance of her husband did the laundry work. Mrs. Brown did little home sewing and hired her laundry done. Both families produced a large part of the food supply but the Browns produced about $80 less, which was not quite made up by cash purchases; and

(2) The difference between planning and drifting. Mrs. Johnson wanted to pay for the farm, build a nice home, and educate her children. She and her husband had worked out a plan for doing this. Mrs. Brown said, "We just buy what we can when we can."

That a family cannot get on in farming unless they can put a relatively large amount back into the farm is clearly shown in farm home accounts secured from 500 farm families which study is reported in Bulletin No. 320 of the Mississippi Experiment Station, Family Living on Poorer and Better

SUMMARIES OF FARM HOME ACCOUNTS OF TWO TYPICAL MISSISSIPPI FARM FAMILIES

The Johnson Family:

1. Family members: husband 30 years, wife 28 years, daughter 9 years, son 5 years, daughter 1½ years
2. Land owner (120-acre farm)
3. Income (1939)

Net money income from farming	$215
Earnings of husband (nonfarm work)	110
Total money income	325
Nonmoney income:	
Value of food furnished by farm	333
Value of fuel furnished by farm	35
Rental value of home	40
Inventory change in livestock and crops stored for sale	35
Total nonmoney income	443
Total income	768

4. Cash expenses for family living (1939)

Household operation (such as lights, fuel, ice, telephone, household labor, cleaning supplies)	25
Auto	0
Travel and transportation	18
Food (at home)	60
Food (away from home) such as Coca-Cola, candy, etc.	1
Recreation	32
Reading	3
Tobacco	11
Medical care	25
Personal care (such as toilet supplies, barber, beauty parlor)	6
Education	3
Household equipment and furnishings	1
Gifts and poll taxes	9
Clothing	50
Burial insurance	4
Total cash expenses for family living	250

5. Change in net worth + $75; made payment on farm

The Brown Family:

1. Family members: husband 33 years, wife 32 years, son 13 years, and son 7 years
2. Cash renter (80-acre farm)
3. Income (1939)

Net money income from farming	$230
Earnings of husband and son (nonfarm work)	100
Total money income	330
Nonmoney income:	
Value of food furnished by farm	256
Value of fuel furnished by farm	35
Rental value of home	60
Inventory change in livestock and crops stored for sale	40
Total nonmoney income	391
Total income	721

4. Cash expenses for family living (1939)

Household operation (such as lights, fuel, ice, telephone, household labor, cleaning supplies)	67
Auto	51
Transportation	10
Food (at home)	120
Food (away from home) such as Coca-Cola, candy, etc.	20
Recreation	67
Reading	3
Tobacco	0
Medical care	50
Personal care (such as toilet supplies, barber, beauty parlor)	21
Education	10
Household equipment and furnishings	3
Gifts and poll taxes	14
Clothing	140
Burial insurance	4
Total cash expenses for family living	580

5. Change in net worth — $250; sold auto Sept. 1939 for $250 to pay debts

TABLE 1—A COMPARISON OF EXPENSES FOR FARM, FAMILY AND INVESTMENT OF 125 FAMILIES WITH HIGHER INCOMES AND 125 FAMILIES WITH LOWER CASH INCOMES, MISSISSIPPI, 1934

	Amount of expenses by families of:			
	Higher incomes		Lower incomes	
Kind of expense	Amount	Per cent	Amount	Per cent
Farm	$380	50	$111	40
Family	313	40	151	54
Investment	77	10	16	6
Total	$770	100	$278	100

Soil." The average cash expenses for the farm, for the family, and for investments for 125 of the families in the group with lower incomes and 125 of the families in the group with higher incomes are summarized in table 1. The families with higher incomes spent $380 on their farms, or 50 per cent of the total cash available. Those with lower incomes spent $111, or 40 per cent of the total cash available. The lower income families averaged only $16 for new buildings and equipment, livestock additions and insurance, while the higher income families averaged four times more.

The poor farmer is poor because he does not put enough back into his farm and does not put enough back into his farm because he is so poor that he must use as much as possible for family living. The woman on the farm can help remedy this situation by managing the cash she does have and her time in such a way as to spare the dollar. Even $20 released for a piece of farm equipment may lead to a higher cash income and in turn to a general improvement in family living.

Using Time Where It Counts Most

From a large number of farm homemakers have been secured detailed weekly records of all activities carried on by them and of the time spent in these activities. It would seem from these records that the average farm homemaker gives about 60 hours a week to farm and homemaking activities, or 3,120 hours a year. Since every week is a full week, it is important that she devote her time to those activities which will count for most. Is there any method whereby she can make a rough check? Any method whereby she can tell whether home production pays?

Measuring Home Production Value

The less a family has, the more home production pays.

A saving of 25 cents on a task that requires 2 hours would not mean much to the farmer's wife with $1,250 a year to spend; but what of the wife with $125 a year to spend? The extent it pays a farm homemaker to engage in various activities would thus seem to depend on the cash available for family living. A means of valuing household tasks for this group thus suggests itself. It is as follows: Divide the amount of money available for family living during the year by the number of working hours during the same period, and this will give the homemakers's wage rate per hour.[1] Thus, a homemaker with $300 a year available to spend for family living would rate her services at 10 cents an hour. One with $150 a year available to spend for family living would rate her services at 5 cents an hour. One would not engage in those tasks which would not net the hourly wage rate if the goods or services could be purchased on the market in the quantity and of the quality desired, except in those cases where the tasks themselves were pleasurable.

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[1] We are assuming here that the woman cannot get gainful work outside the home, or finds it advisable to remain at home. This is the situation of the majority of homemakers in rural areas of Mississippi.

Studies made in this Department furnish much material for illustrating further the suggested method, especially the use of time in clothing construction and in food production.

Savings Made by Sewing

In 1928-29, 99 farm homemakers cooperated with the Home Economics Department in a study of money and time costs of clothing their families. See Bulletin No. 294 of the Mississippi Experiment Station for the report of this study. It is possible with the use of these data to make a rough test of the suggested method of valuing the homemaker's time. A majority of the families in the study spent about $500 a year for family living, which would yield a wage rate of 16 cents an hour, assuming the surveyed homemakers spent as much time on household activities as do the majority of farm homemakers. About 171 hours per family were spent in the construction of clothing, which means that home sewing should have netted a saving of approximately $27 per family.

In the chart below are listed the members of a typical family of the study with those garments which were added during the report year that were most often homemade. The homemade and purchased prices listed are average prices paid for these garments by the farm families concerned. Assuming that the homemade and readymade garments are of equal quality, the wife in the typical family saved enough to meet her wage rate. Many of the garments which

APPROXIMATE SAVING MADE THROUGH HOME SEWING BY A TYPICAL FARM FAMILY IN THE 1928-29 CLOTHING STUDY IN MISSISSIPPI

Family member	Garment	Number garments	Cost homemade	Cost readymade	Amt. saved by making
Husband 35 years	Shirts	4	$0.83	$1.20	$1.48
	Underwear (1 pc.)	2 pr.	0.42	0.96	1.08
	Nightshirts	1	0.62	0.78	0.16
					$2.72
Wife 33 years	Cotton dresses	6	1.26	1.73	2.82
	Silk dresses	1	4.47	10.63	6.16
	Underwear (1 pc.)	2 pr.	0.33	0.73	0.80
	Bloomers	1 pr.	0.38	0.61	0.23
	Slips	1	0.53	1.40	0.87
	Gowns	1	0.61	0.91	0.30
					$11.18
Daughter 13 years	Cotton dresses	8	1.19	1.76	4.56
	Silk dresses	1	5.64	7.73	2.09
	Slips	2	0.66	1.05	0.78
	Gowns	1	0.75	1.08	0.33
	Step-ins	1	0.25	0.63	0.38
					$8.14
Daughter 10 years	Cotton dresses	5	0.78	1.20	2.10
	Bloomers	3	0.35	0.47	0.36
	Slips	2	0.55	0.55	0.00
	Gowns	1	0.26	0.49	0.23
					$2.69
Son 8 years	Shirts	4	0.44	0.78	1.36
	Underwear (1 pc.)	2	0.21	0.49	0.56
	Nightshirts	1	0.41	0.69	0.28
					$2.20
			Total savings		$26.93

FIGURE 1—GOOD USE OF MONEY INCOME DEPENDS ON FAMILY PLANNING FOR ITS USE

were made at home were, however, of superior quality and workmanship as compared with those purchased readymade, and for this reason the value of sewing done by this representative woman has probably been underestimated. This homemaker undoubtedly averaged more than 16 cents per hour.

As may be noted from a study of the chart, it paid to make certain garments more than it did others. Many garments which it paid most to make are not even listed, for they were not ordinarily made at home. Such garments include coats and coat suits, which after one learns a few techniques such as pressing and how to make large, loose stitches, is not nearly so difficult as fine hand sewing. In deciding whether to make or buy a garment—a rayon dress for instance—the homemaker should price readymade dresses such as she would buy, and yard goods of the same description. If the readymade dress sold for $6.00 and she could get similar material for $2.00 or $2.40, including thread and trimming, she would save $3.60 by making. If this dress took 6 hours to construct, then she would earn 60 cents an hour for making it.[2]

Farm homemakers will do well to reexamine savings to be made by home sewing, for in this, perhaps, lies one of the best means of cash sparing to be found in household production today. Especially so in families largely composed of women, girls, and young children. Being a good seamstress does for the clothing budget what being a good carpenter and blacksmith does for the farm budget.

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[2] This does not take into consideration overhead costs, such as deterioration of the sewing machine, scissors and other sewing equipment. Homemade costs include only direct money costs.

Savings Made by Food Production

Unfortunately, this Department has no time records for food production as it does for clothing construction. It does have, however, a great deal of information concerning the kinds and amount of foods which farm families of the State have produced for home consumption, in which production the homemaker has been the guiding light as well as an active worker. We can say that for the average farm the value of this food is greater than is the profit from farming. In the chart below is a list of home produced foods consumed per family by those having the best live-at-home programs in a family living study made by this Department and reported in Bulletin No. 320 of the Mississippi Experiment Station.

The approximate selling price of this food supply in the communities where these families resided amounted to $383, or $70 more than was available in cash for family living. Figures concerning the time it took to produce the food supply and the time spent by the homemaker were not secured, and therefore it is not possible to estimate in terms of dollars and cents just how profitable food production was. It would seem, though that the time spent in these activities

AVERAGE QUANTITY AND VALUE OF FOOD PRODUCED ON THE FARM AND CONSUMED PER FAMILY (125 WHITE FAMILIES, MISSISSIPPI, 1934)

Food	(Average size of family 5 persons) Source and amount	Approximate selling price in communities where families reside
Fresh vegetables	1 or more vegetables 10 months during year	$75.00
Milk	317 gallons—2 milk cows had milk 11 months	127.00
Pork and pork products	3 hogs (dressed weight 600 lbs.)	90.00
Poultry	18 fryers, 3 hens	10.00
Eggs	100 dozen	20.00
Beef	5 pounds	1.00
Fresh fruit	10 bushels	10.00
Peanuts	30 pounds	3.00
Pecans	30 pounds	3.00
Canned foods (fruits, vegetables)	154 quarts	31.00
Dried peas and beans	30 pounds	9.00
Sweetpotatoes	15 bushels	10.00
Dried fruits	20 pounds	3.00
Sirup	15 gallons	8.00
Cornmeal	10 bushels	8.00
	Total	$383.00

more than netted a saving sufficient to justify any time the women might have devoted to them. In averages compiled by F. W. Brumley of the Department of Agricultural Economics, Louisiana State University, it took 70 hours a year to keep one dairy cow, 200 hours per 100 head of chickens, 10 hours per hog, 250 hours per acre of truck crops, 90 hours per acre of sweetpotatoes, and 37 hours per acre of corn and soybeans grown together.

Even though production of certain foods may not have netted the wage in money savings, such foods may have contributed to a better diet. It has been shown in a number of publications of this Department that, as a rule, farm families with low food production do not make up the deficiency by purchases on the market. In dietary studies made in 1926 and 1927, a time when food cost more than it does now, a group of white farm families of very much the same type and size as those whose production is listed in the foregoing chart, produced an average of $476 worth of food, or 74 per cent of their yearly food bill of $644. A group of negro families in the Yazoo-Mississippi Delta averaging 4.5 members, produced $145 of their food at home, or 44 per cent of their yearly food bill of $330. Home production, in other words, made possible an increase in quality as well as quantity of food. The diets of the families whose food supply was valued at $644 were, on the whole, adequate except for a small deficiency in iron, the blood building mineral, and Vitamin C, which is found in raw foods. The food supply of the negroes, which was valued at $330, was low in all the nutritive factors. These white families with only $700-$800 to spend for family living would not or could not have spent $644 in cash on food. Home production made their good diets possible.

FIGURE 3—THE FINAL PRODUCTS ARE GREATER WHEN HUSBAND AND WIFE WORK TOGETHER

Using Money Where It Counts for Most

In the illustration given in the first part of this report, we have in the Brown family a good example of money being used to lower the economic status of the family rather than to raise it. Unfortunately, this is only one of the farm home accounts that might be cited from many available. The full responsibility for such records cannot, of course, be laid altogether on the wife of the family, but she is certainly partly responsible. She has a say as to what goods the family shall have, and she does the major part of the purchasing. Had she called to the attention of her family that the 10 cents a week that each of them spent for bottled drinks would buy the new cultivator they so sorely needed? And that the new cultivator would probably result in better income and better living?

Misuse of money income for family living results from two causes:

(1) Lack of family planning for its use, and

(2) Ignorance on the part of the wife of the qualities in goods that make them suit their purpose.

Planning for use of money income is the joint responsibility of the husband and wife, and depends on their long-time farm plans. Without such long-time farm plans the wife, as well as the husband, is very likely to use the cash they do have to satisfy wants of the moment; to pay $36 for a radio when they might purchase one for $12.50 and have enough left to buy and install an electric brooder. Rarely was a good use of money income observed in families in which the wife had no part in making the farm plans or in families where she failed to take an interest in the many farm problems. Good use of money rests first on planning for its use, and it is the part of the wife as a partner in the farm business to assist with the plans and help carry them out.

There was evidence that homemakers were ignorant of the qualities in goods that make them suit their purpose. A number selected cheaply constructed furniture of the "gingerbread" type, furniture which in only a few years will be in the trash heap. Other homemakers bought large amounts of medicine which claimed to cure—medicine which even though not harmful in or of itself, was harmful in its final results, as it prevented treatment when it was most needed. Some women were purchasing credit without knowing what it cost. In failing to ask the cash price for goods they had no means of determining whether the cost of credit was worth the waiting period. Further study of goods and services on the market is needed by many. Such information is being made more and more available.

IMPROVING FAMILY HEALTH

That there are two means whereby the homemaker may improve the health and in turn the economic status of her family has been shown in studies made by this Department. In one of these studies in which two groups of white families kept records of the weights of foods consumed by them during certain periods of the year and records of all illnesses of family members in this period, those families with poorer diets were more often ill. They more often showed conditions indicating poor health (table 2). Frequent colds, constipation, and rheumatism were conditions more often shown by both adults and children in families on poorer diets. Loss of appetite was much less frequent among adults having better diets.

Good Diet, Good Health

The children in the group of families on poorer diets averaged three times more days of illness than did the

TABLE 2—FREQUENCY OF SYMPTOMS INDICATING POOR GENERAL HEALTH BY MEMBERS OF FAMILIES WITH BETTER AND POORER DIETS, MISSISSIPPI, 1926

	Adults		Children	
Condition	131 persons Better diets	118 persons Poorer diets	170 persons Better diets	129 persons Poorer diets
	Per cent	Per cent	Per cent	Per cent
Frequent colds	19.0	26.2	33.5	34.8
Constipation	30.5	34.7	11.2	12.4
Digestion easily upset	16.0	14.4	9.4	10.8
Headaches	17.5	15.2	4.7	0.7
Rheumatism	19.8	22.8	1.7	4.6
Loss of appetite	5.3	12.7	*	*

*Data not obtained.

children in the better fed group. Their rate of gain in weight was lower. They were more susceptible to infectious diseases and to illnesses due to conditions of the stomach and intestines. These differences were likewise found in the adults of these two groups, but to a less extent. Such conditions diminish present earning capacity of adults and future earning capacity of children.

Not only do poor diets lower present and future earning ability, but they cause expenditures for medical care and other services which may cost as much as a fourth of the cash income, or even more—money that is sorely needed for improving the farm or farm home. Sickness in the family has kept many a farmer from buying needed farm equipment or land. It has lowered the bargaining power of many a sharecropper. It has prevented many a boy and girl from getting an education and from following the occupational careers which they so desire and have the native ability to pursue.[3] It therefore behooves every homemaker to see that an adequate food supply is provided for her family; and even this is not enough. The food supply must be prepared in such a manner as to conserve the minerals and vitamins. That poor cooking can make an adequate food supply inadequate has been very well shown in Bulletin No. 291 of the Mississippi Experiment Station.

The Value of Good Cooking

In this study seven vegetables—turnip greens, mustard greens, collards, butterbeans, string beans, field peas and English peas—were cooked by five methods: (1) boiling 1 to 2½ hours in more than enough water to cover; (2) boiling ½ to 1¼ hours in a little less than enough water to cover; (3) boiling ½ to 1½ hours in from ½ to ¼ enough water to cover; (4) steaming ½ to 1½ hours; and (5) cooking in a pressure cooker 8 to 15 minutes. The vegetables were analyzed for iron, one of their most important mineral constituents, both before and after cooking. The greatest loss of iron resulted in every instance when the vegetable was cooked by the first method (boiling 1 to 2½ hours in more than enough water to cover). The average loss for the seven vegetables was 20.5 per cent. Boiling by the second method led to a smaller loss of iron in every instance, the average loss being 16.6 per cent. A much smaller loss of iron occurred in every vegetable except one when they were boiled by the third method, the average loss being 9.8 per cent. The smallest loss of iron occurred when the vegetables were steamed or were cooked in the pressure cooker. The average loss of iron for the seven vegetables cooked in the steamer was 6.9 per cent, and for the five vegtetables cooked in the pressure cooker was 5 per cent.

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[3] See page 39, "Occupations of Sons and Daughters of Mississippi Cotton Farmers", by Dorothy Dickins, Miss. Agri. Exp. Sta. Bulletin No. 318, May 1937.

Unfortunately, we cannot cook all vegetables by boiling in a small amount of water, by steaming, or in pressure cooker and produce a palatable, sightly product. Steaming and cooking in a pressure cooker causes destruction of the color of green vegetables. If the strong flavored vegetables, such as onions, cabbage and collards, are cooked in this way or boiled in a small quantity of water, they develop an undesirable flavor and odor. Therefore, the method generally recommended for strong flavored vegetables is boiling in enough water to cover in an uncovered vessel. All vegetables, whether they are steamed or boiled, should be cooked a minimum time if their nutrients, especially iron which is readily lost, are to be conserved, as well as their flavor and color preserved.

The Value of Sanitation

Another means of protecting the health of her family, and in turn their economic status, is by insisting upon sanitary precautions, such as proper sewage disposal, screening, and a pure water supply. In the family-living study of 1934 previously referred to, 60 per cent of the homes of the poorest white and negro families had no toilet facilities; 75 per cent of their houses had no screens. A number used cisterns. The expenditures for sickness and death in 11 per cent of these families were more than 25 per cent of their total expenditures for family living. These expenditures cannot, of course, be attributed altogether to lack of sanitary precautions in the homes of these families, but such deficiencies no doubt played a part. Cash expenditures tell only part of the tale, for low income families usually do not seek medical attention until it becomes most urgent. It is entirely possible that the efficiency of many members in these families who had made no cash expense for medical care was materially lowered from malaria and hookworm.

Since the 1934 study many of these homes have been screened. Many sanitary pit toilets have been installed through WPA projects under the direction of the sanitary engineer of the State Board of Health. This is the kind of opportunity that farm homemakers **must** not fail to take advantage of. Screens at windows, doors, and other openings of the house are needed to keep out the mosquitoes. Sanitary toilets are needed to protect against soil pollution.

ACTING AS A PARTNER IN THE FARM BUSINESS

Just as the efficient use of money income, or of time and effort, by the women of the household contributes to improved farm family living, so does keen interest in the farm business contribute. This is not the sort of thing upon which it is easy to assemble data, yet in interviews with hundreds of farm women it becomes self evident. "Yes, we bought a mule this year," replies one farm woman. "We are expanding our farm business. We paid for the mule out of what we cleared from the truck crop, and sold the truck to Hinman Brothers in town. We hope to wire the house this spring." Another replies, "I know nothing about the farm. Have more than I can do in the house. My husband attends to his business, I to mine."

Woman's Sphere on the Farm

Many farm women, when asked what their occupation is, reply, "Just a farm homemaker," but being a good farm homemaker requires both thought and skills. When thoughts and skills are applied, the reward is great—not only for the present welfare of the family, but for its future.

A wife who takes an active interest

in the farm helps make the farm plans, understands the many farm problems, assists in making adjustments of the farm budget, and helps with farm chores. Helping with farm chores does not mean, of course, becoming a wage worker on the farm. From data obtained from white rural women of the State, it would seem that the majority do work in the field. In a study of young women from 19-33 years of age, 65 per cent of the married group and 88 per cent of the single group ordinarily did field work.[4] The amount done of course varied from assisting in the peak seasons of cotton chopping and picking, to working side by side with the men of the family.

Conserving Money Income

In families with only one woman, many hours of field work would seem an unwise use of time. The farm woman has a distinct economic contribution to make in feeding, clothing, sheltering. nursing and training members of her family; and she cannot do this when she remains in the field for long periods. That so many rural women spend much time in the field is only another manifestation of the emphasis which is placed on money crops. Sooner or later the nonmoney income to which the wife contributes largely will take its rightful place. In the meantime, farm women might very well sit down with pencil and paper and list the gains and losses from regular field work. These are some of the losses which have been observed: (1) hurriedly planned and poorly cooked meals; (2) clothing needing repair; (3) readymade, poorly constructed garments of shoddy material; (4) "running" noses; (5) disorderly children; (6) limited poultry supply; and (7) gardens choked with weeds.

In table 3 are given some figures whereby the value of the wife's contribution to the income may be estimated. These figures are taken from a special analysis made of data from a study now in progress by this Department. The families included in table 3 are all young families, the husband in every case a small scale farmer. As may be noted, families in which the wife remained at home had a money and nonmoney income from the farm of $123 a year more than those working away from home. These figures give us some idea of what part the wife, a partner in this business, contributed to the income, but no idea of what her presence at home saved.

Adding to Money Income

As a partner in the farm business, the woman may not only increase the nonmoney income of her family and at times lend her assistance in the production of field crops, but she may also raise for sale certain foods which may be produced near the house and do

TABLE 3—A COMPARISON OF THE NET INCOMES FROM FARMING AND OF THE VALUES OF FOOD AND FUEL FURNISHED BY THE FARM IN FAMILIES OF FULL-TIME FARMERS WITH WIFE A FARM HOMEMAKER AND WIFE EMPLOYED IN INDUSTRY

Item	Wife farm homemaker	Wife industrially employed
	Amount	Amount
Net income from farming	$119	$83
Value of food produced on farm for family consumption	268	197
Value of fuel furnished by farm	41	25
Totals	$428	$305

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[4] "Occupations of Sons and Daughters of Mississippi Cotton Farmers," by Dorothy Dickins, Miss. Agri. Exp. Sta. Bulletin, No. 318, May 1937, pp 67-71.

TABLE 4—GROSS VALUE OF FOOD PRODUCTS SOLD BY 250 WHITE AND 250 NEGRO FARM HOMEMAKERS IN MISSISSIPPI, 1934

Products sold	Number selling	Average amount earned by those selling
Poultry and poultry products only	172	$9.44
Dairy and poultry products only	34	66.67
Dairy products only	20	55.43
All others	17	17.32
Total	243	$21.78

not require constant attention during long periods at any one time. In other words, she may lend her energies as well as her moral support towards making the farm a diversified one. Foods produced by the wife or daughter in a family are part of the farm income—as much a part of this income as is the cotton.

In table 4 is given the gross value of food products sold by 500 farm homemakers in 1934. As may be noted, a little more than 50 percent of the group produced none of these for sale. About one-third sold only poultry and poultry products. In the "all others" group are included those who sold fruits, vegetables, or potatoes only, or in combination with poultry and dairy products. The sale of poultry and poultry products would thus seem to hold the greatest possibility for cash farm income for rural women of Mississippi. The gross receipts from these products will remain low, however, as long as poor stock is used and poor feeding methods are continued. The farm woman, just as the farm man, should know and put into practice the best known methods of production.

As a partner in the farm business, the farm woman must concentrate first on increasing the nonmoney income of her family, and second, on increasing the money income. But this is not enough. Her contribution needs to be indirect as well as direct. She must exert the sort of stimulus that her husband and children need to "get going". She must mold her family into a unit of cooperation, the activity of one member complementing and supplementing the activity of the other. This immeasurable contribution yields great rewards, for the final product is always greater when all work together than when each works independently.

ENGAGING IN NONAGRICULTURAL PURSUITS

In view of the fact that self-sufficing farms rank third in importance in Mississippi and that net profit from farm operation is often less than $100 a year, there is need for canvassing sources of income other than agriculture for rural women. There are two possibilities: (1) handicrafts, and (2) gainful work away from home.

Handicrafts

That the possibility of handicrafts has been overlooked by the vast majority of rural women in the State is quite evident from studies made in this Department. In one of these studies, only 6 married women out of 327, and only 4 single women out of 116 earned in this manner.[5] Canning, crocheting, and sewing, were the means whereby they earned. No doubt there needs to be a revival of the simple skills of our grandmothers in families needing supplementary cash income, especially among rural women with children, among women nearing middle age or older, and among women located on out-of-way

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[5] "Occupations of Sons and Daughters of Mississippi Cotton Farmers," by Dorothy Dickins, Miss. Agri. Exp. Sta. Bulletin No. 318, May, 1937, pp. 67-71.

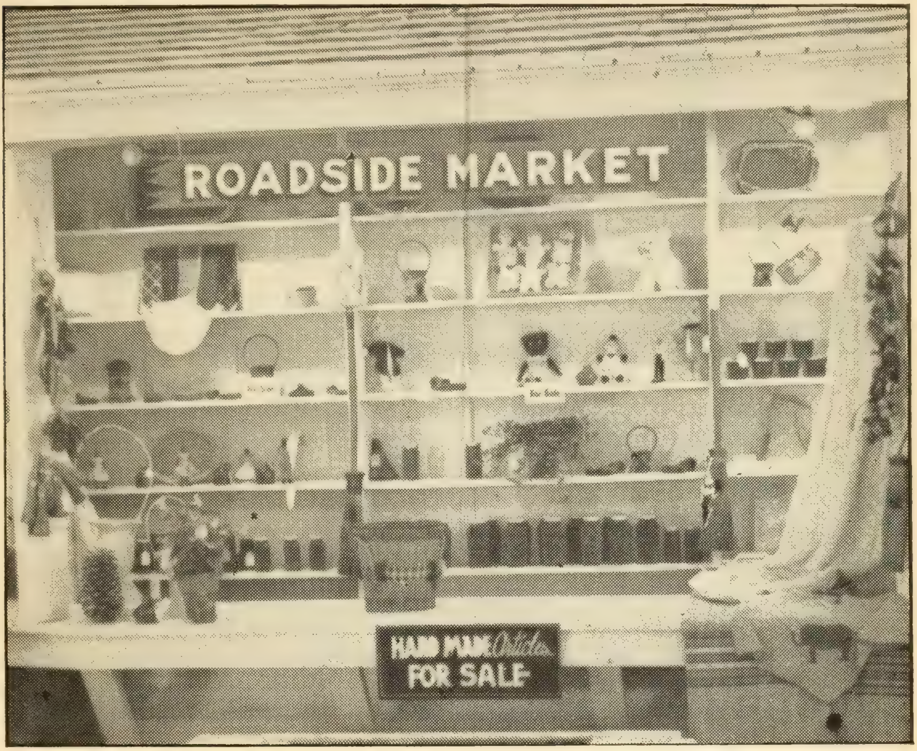

FIGURE 4—HANDICRAFTS THAT ARE YIELDING A CASH INCOME TO RURAL WOMEN

farms. In unpublished material obtained by this Department, it has been very definitely shown that opportunities for gainful work away from home are limited for these groups. The first step in earning by means of handicrafts is learning how to make some one thing well—whether baskets, or fig preserves, or baby dresses, or flower wreaths, or pecan cookies. Agricultural extension agents, teachers of vocational home economics and WPA adult education teachers give such instruction. It is up to the individual worker to develop the skill. It has been the experience of those skilled in handicrafts that once a quality product is made, it will find ready sale.

Gainful Work in Industry

There are at present few opportunities for gainful work away from home for rural women of Mississippi. With the improvement in roads and the expansion of industry, however, these opportunities are increasing. In a random sample of white women in rural areas of Attala, Clarke, Forrest, Itawamba, and Lauderdale Counties, Mississippi, including 2,576 women 16 years and over, only 7 to 17 per cent had been gainfully employed away from home as much as 5 months during the previous year. All of these counties have industries employing women. The women employed are for the most part young women, whether single, married, widowed or divorced. Those residing in the open country usually lived on good roads not too far away from the plant.

Some of the benefits of an industrial program for women in poor agricultural areas are now being studied by members of the Home Economics Department. Such a program has been found to improve the economic status of many farm families and especially when the working women reside at home. Single women living at home contribute much more towards improving the economic status of their parental families than those living elsewhere. Wives of young farmers improved greatly the economic situations of their own families. Many were using their earnings for buying land and a home, or for getting a good start in farming. Only one woman in five of this group had more than one child.[6]

Work Away from Home

The problem of the farm woman with children seeking gainful work away from home is not yet one of great importance in Mississippi. It may, however, become increasingly so if the supply of young women now employed remain in the plants. Whether these women should continue work after their children come is, of course, a problem for them and their husbands to decide. In some of these families the cash income from farming may be so very low, and the demands for cash income so very great, that every possibility for adding to cash income will have to be utilized. Before the decision to work away from home is finally reached, the gains and losses from working outside the home need to be listed and most carefully considered. Women working away from home have expenses for transportation, more expenses for clothing, beauty parlor, lunches, soft drinks. Their contribution to the nonmoney income of the family is reduced greatly. They can no longer enter into active partnership in the farm business with their husbands. The money income from farming is thus reduced. The possible effects of the absence of the mother upon child development are difficult to determine. The effects of absence of the mother may be more detrimental during late childhood and early adolescence than in infancy, and especially so in the case of the daughter. Studies at the Nebraska Experiment Station show better personal adjustment (that is, they are more successful in dealing with other people and in meeting new situations, and have fewer emotional problems or upsets) of the farmer's daughter when her mother does not work outside the home.[7]

GUIDING FUTURE PRODUCERS

The farm woman can improve the economic status of the future family as well as that of her own. **The kind of training which her children receive at home determines largely what their economic status will be when they leave the parental home.** That habits of work and thrift formed under mothers' direction last when children get out on their own, is generally known. That few children get an education without some encouragement at home is also a well known fact

Economic Value of Education

The close relation between illiteracy or near-illiteracy and poverty, however, is a fact that is apparently often overlooked. Many women think of schooling more in terms of the social advantages that it can give their children. That the schooling one has affects future economic status also is a fact that has been demonstrated in studies made by this Department.[8]

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[6] Data taken from an unpublished study by this Department.

[7] Personality Development in Farm, Small-town, and City Children, Leland H. Stott, Nebr. Agri. Exp. Sta. Bulletin No. 114, Aug. 1939, p. 10.

[8] "Occupations of Sons and Daughters of Mississippi Cotton Farmers", by Dorothy Dickins, Miss. Agri. Exp. Sta. Bulletin No. 318, May 1937.

TABLE 5—OCCUPATIONS OF 160 FARMERS' SONS 19-33 YEARS OF AGE ENGAGED IN NONAGRICULTURAL WORK CLASSIFIED BY SCHOOLING THEY RECEIVED, MISSISSIPPI, 1934

Occupation	Schooling received				
	Eighth grade and under	High school training	High school graduate	College training	All sons
	Per cent	Per cent	Per cent	Per cent	Per cent
Unskilled and semi-skilled laborers	65 0	34.5	46.8*	26.1	45.0
Skilled laborers	21.2	24.1	18.8	......	18.7
Managers, clerks and kindred workers	4.3	37.9	28.1	26.1	24.4
Professional men	....	......	......	34.8	5 0
Independent business men	8.5	3.5	6.3	13.0	6.9
Totals	100 0	100.0	100.0	100.0	100.0

*Includes a number in CCC camps.

TABLE 6—EDUCATION OF WOMEN MARRIED TO FARMERS CLASSIFIED BY FARM TENURE OF THEIR HUSBANDS, MISSISIPPI, 1934

Tenure of husbands	Schooling received by wives				
	Eighth grade and under	High school training	High school graduate	College training	All farm home-makers
	Per cent	Per cent	Per cent	Per cent	Per cent
Owners	16.7	24.6	37.8	50.0	22.0
Managers	0.7	1.6	......	......	0.9
Tenants	78.8	70.8	62.2	50.0	74.1
Wage workers	1.9	0.7	......	......	1.2
Noncash assistants*	1.9	2.3	......	......	1.8
Totals	100 0	100.0	100.0	100.0	100.0

*Those working on the family farm without a definite financial agreement.

In tables 5 and 6 is shown how the occupational status of two of the groups studied varied with the formal education they had received.[9] As may be noted, farm reared men with eighth grade schooling or less in nonagricultural work were usually unskilled and semiskilled laborers, or in the lowest earning class. Skilled laborers and managers, clerks and kindred workers came more largely from the group with high school training. All professional men had some college training.

Formal education apparently affects the kind of marriage a young woman makes. The more schooling had by the wife of a farmer, the more likely it is that the farmer will be a landowner. The better educated women may assist their husbands in becoming landowners more than the less educated. It has been shown that one of the factors affecting farm income is the help and stimulation men receive from their wives. The relationship between education of the wife and occupation of the husband is undoubtedly even greater than is indicated in table 6, for the husbands of the women included in this study are young. Many of them will become landowners. Then, too, this study was made at the peak of the world-wide business depression when opportunity for farm ownership was at the minimum.

The Mother's Influence

From the occupational study made by the Department it would seem that good schooling for the daughter is even more important than for the son, since the schooling which the mother has is more closely related to the schooling that her children receive than is the schooling of the father. With well educated mothers the farm children of the future will be inspired to seek more training. Many more will then enter the higher paid fields. This will release some from farming which may tend to send up the income of those who remain in this occupation.

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[9] For a full discussion of all groups, read pages 59-96 of Miss. Agri. Sta. Bulletin No. 318.

Formal education is, however, not a panacea for all economic ills. There are some who succeed with little schooling, but these avail themselves of the many opportunities which are theirs for the seeking. Thus one of the farm-reared men in the occupational study, now an owner of a machine shop, writes, "I am of a very poor family. I went to school from 3 to 5 months each year until I was 17 years old. Left home and married at 19. Took mechanical work, electrical work, plumbing, pipe fitting, and plastering. All these five trades I learned by observation and experience." This man is the son of a farm family who have never owned land. None of the three children reared in this family had much schooling, yet all are succeeding in an occupational way. The mother of the family is known as a "hard working woman who taught her children right."

In guiding future producers, it is the duty of the farm homemaker to develop habits of industry and thrift in her children, to see that they attend school regularly, and study the lessons assigned. This is not enough. As a member of the community, she needs to use her influence in seeing that the right type of educational opportunities are provided—education that not only trains for life in agriculture, but teaches skills and vocations which would benefit the individual if he or she should migrate from the community in which he resides.

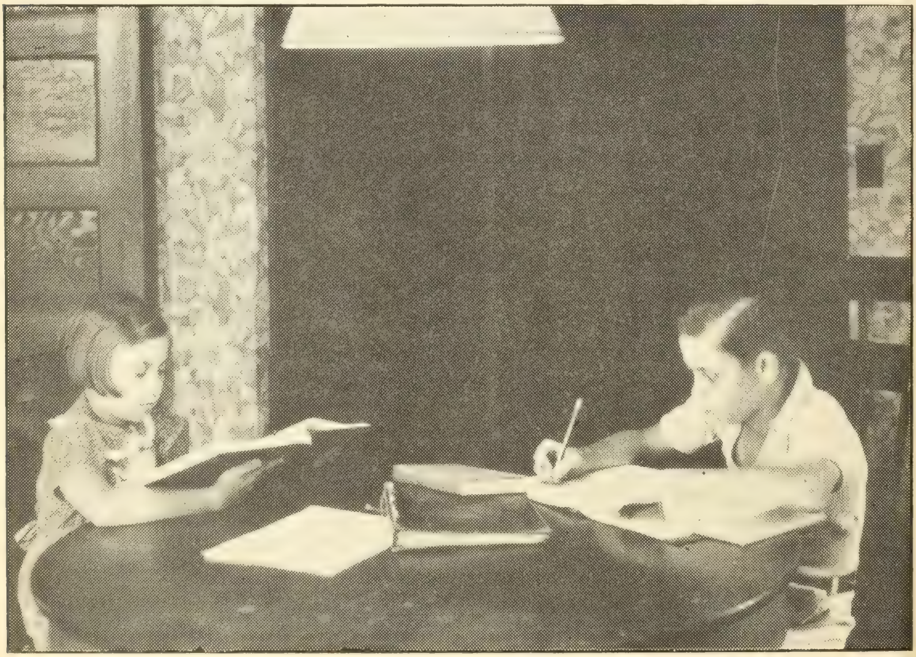
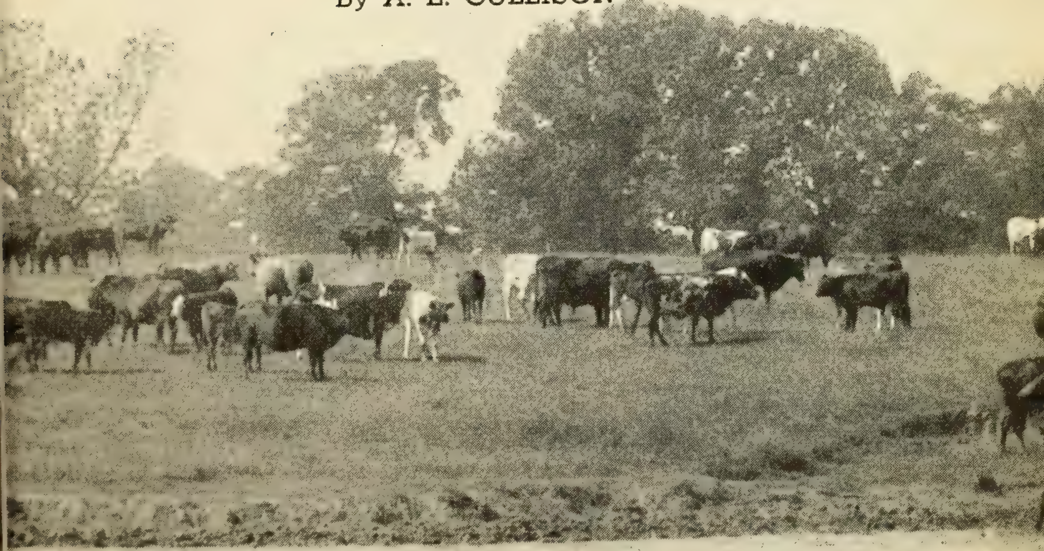


FIGURE 5—STUDY TIME FOR THE FARMER'S CHILDREN

Bulletin No. 347 August, 1940

The Influence of Breeding on The Performance of Beef Calves Produced in Mississippi

By A. E. CULLISON



Mississippi Agricultural Experiment Station
CLARENCE DORMAN, Director
State College, Mississippi

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The Influence of Breeding on the Performance of Beef Calves Produced in Mississippi

By A. E. CULLISON
Animal Husbandry Department

The South's farm income in the past has been dependent to a marked degree upon a single farm enterprise—cotton production. Consequently the rather poor market for cotton during the past few years has struck a disastrous blow on the income of the Southern farmer.

In light of the above condition the farmers of Mississippi, like most Southern farmers, are seeking some profitable enterprise with which to supplement cotton production and increase their annual income. Such farmers may find the contents of this bulletin to offer some helpful suggestions in this respect.

With the advent of a government program of crop and soil erosion control on most Mississippi farms, many farmers in the State find their increased production of such feed crops as hay, silage, and pasture, and in some instances grain, to be far in excess of what they need to feed the livestock they now have. Also at the same time they have found that such products do not have a very high market value.

On the other hand in certain sections of the State there are large numbers of native cows which, because of inadequate feed supplies and other adverse conditions, have failed to yield maximum returns. In many instances breeding cows from these herds can be purchased at very reasonable prices. This bulletin, among other things, illustrates the practicability of using such cows as a basis for an enterprise which would put feed surpluses of low market value to profitable use for beef production and so make for a larger annual income on many Mississippi farms.

A farmer desiring to carry on a beef cattle enterprise in connection with his other farming operations must adapt such an enterprise to the conditions which exist on his particular farm. In the event that he has large supplies of roughages with little or no excess grain he probably should confine his efforts to the production of feeder calves to be sold from teat at weaning time.

If, in addition to large supplies of roughage, however, he has considerable grain, he may find it profitable in the long run to take the calves which he has produced to weaning age and place them on a grain fattening ration and sell them later as fat calves.

On the other hand, if he has little or no surplus roughage feed but large supplies of grain, he may find it advisable not to produce his own calves but to purchase them as feeders and carry on only the fattening phase.

Although the financial statements of this bulletin do not show very large returns above feed and calf costs from the latter practice, it must be remembered that in calculating these tables relatively high market prices were assumed for the feeds fed. Hence an attractive feature of this type of program, aside from any actual profits, is that it furnishes a good home market for surplus feed crops.

Regardless of the program followed, as long as it is adapted to the existing conditions, there are many advantages to be

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Note: This experiment was planned and supervised during the first year of its progress by Dr. E. W. Sheets, formerly of the Mississippi Experiment Station. A progress report on the first test in this experiment was made by Professor H. H. Leveck, Head of the Animal Husbandry Department, in the September, 1939 issue of the Mississippi Farm Research.

received from the efficient blending of a beef cattle enterprise into the business of many Mississippi farms. In addition to furnishing a good home market for surplus feed crops, as mentioned above, such an enterprise will help greatly to provide work for farm laborers throughout the year. During slack seasons when there is little work to be done on crops, considerable labor can often be profitably marketed through the beef cattle herd. Also the manure resulting from beef cattle feeding is extremely valuable in maintaining and improving soil fertility.

It is sincerely hoped that this bulletin will be of help to those planning to inaugurate a beef cattle program on their farms.

Introduction

As the agriculture of Mississippi becomes more diversified, farmers throughout the State are showing an increasing interest in beef cattle production. This newly generated interest has brought growing demands on the part of Mississippi farmers for information on the various phases of the beef cattle industry.

Of the many inquiries received by the Animal Husbandry Department of the Mississippi Experiment Station along this line, probably the most common one is in regard to the use of purebred beef bulls for siring calves from Native Mississippi cows. The question regarding the best breed to use for this purpose is also a common one.

Many experiments have been conducted along this line at experiment stations in other parts of the country. Although the results of these experiments could be sent to Mississippi farmers in answer to the above questions, there is a feeling by some that these results might not be applicable to Mississippi cattle under Southern conditions. Hence there developed a need for conducting an experiment such as the one here reported.

Object

The object of this experiment was to determine the influence of breeding on the performance of beef calves produced in Mississippi.

Duration of Study

This study extended over a period of three years, beginning in the Spring of 1937, and ending in the Spring of 1940. During this time, two similar tests were completed. The second test was carried on as nearly as possible in repetition of the first test in order that the results of the two tests might be checked with each other.

PLAN OF WORK

This experiment was set up to compare the performance of calves produced in Mississippi from six different types of parentage as to their efficiency for producing beef during (1) a suckling period, and (2) a fattening period. Five lots of calves out of Native Mississippi cows and sired by Native, Polled Devon, Polled Shorthorn, Polled Hereford, and Aberdeen Angus bulls, respectively, as well as a mixed lot of high grade Hereford and Angus calves, were used.

Cows and Bulls Used

The cows and bulls used for producing the first five lots of calves were the same for both tests, with the exception that the original Polled Devon bull was replaced at the beginning of the second test by another Polled Devon bull of similar type and breeding.

The cows used for producing the first five lots of calves were purchased by the Experiment Station in the late Summer of 1936. They were selected from Native cattle herds of Pearl River and Lamar Counties in South Mississippi. No improved breeding had ever been introduced into these herds to the knowledge of their previous owners. These cows were of red, white, and black colors with solid, spotted and brindled variations.

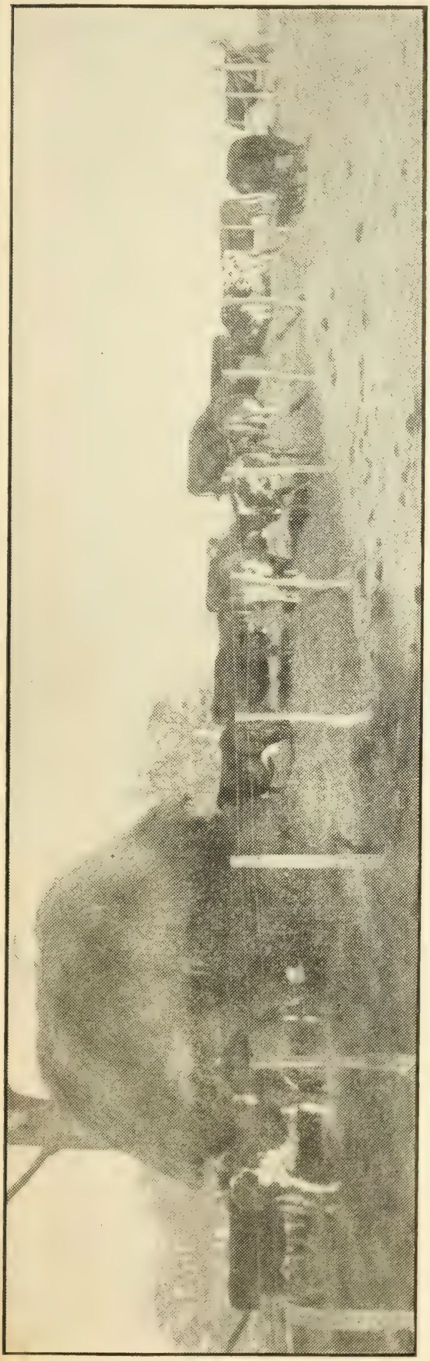

FIGURE 1—NATIVE COWS, THE DAMS OF CALVES TESTED, SHOWN IN WINTER QUARTERS. NOTE STACKED HAY AND TEMPORARY FENCE.

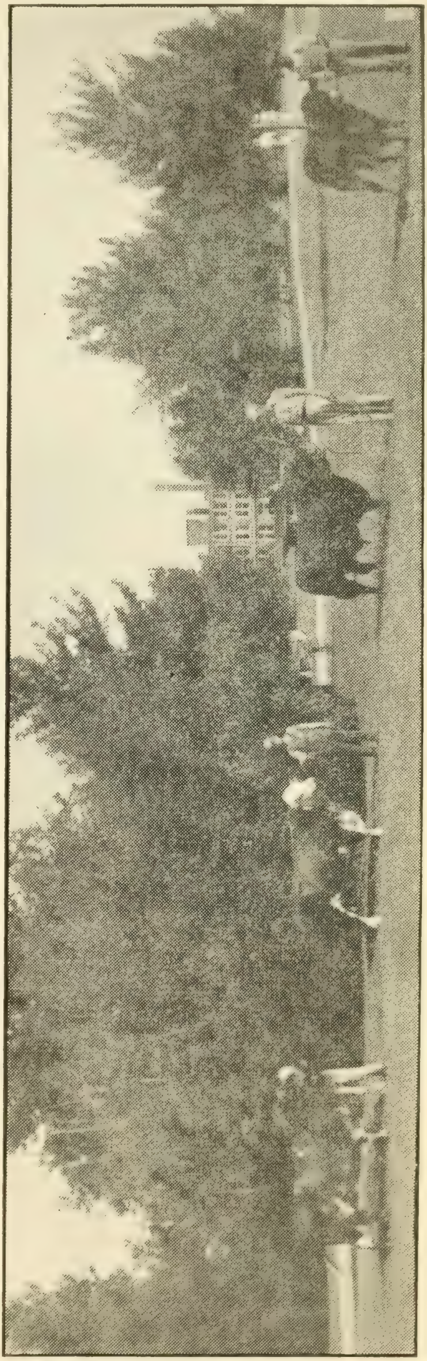

FIGURE 2—PUREBRED BEEF TYPE SIRES OF CALVES USED IN EXPERIMENT. SHORTHORN, HEREFORD, ABERDEEN ANGUS, DEVON.

They had an average weight of 566 pounds per head after two weeks on good pasture following their arrival at State College. At the end of an additional two and one-half months of grazing on good pasture, these mature cows had gained an average of 145 pounds per head. On October 25, 1939, after being on the Experiment Station farm for a little over three years, these cows had made a total average gain of 272 pounds per head, having an average weight of 838 pounds per head on the above date.

Although this gain in weight was partly due to the cows becoming fatter, it was to a large extent the result of actual growth and development. Apparently there was some nutritional deficiency present under South Mississippi conditions which was corrected under the conditions existing at State College.

These cows were divided into five uniform groups at the beginning of the experiment and each group was bred to its respective bull at the start of each test.

All the bulls used for siring these first five lots of calves were of superior beef type and breeding with the exception of the Native bull. This bull, like the Native cows used in the study, was of non-descript breeding, having also come from a Native cattle herd of South Mississippi.

The two Polled Devon bulls used in the study were from a herd located in Bonsall, California. These bulls were typical of the Devon breed except for their polled character. Both bulls were thrifty, well-grown and of good type.

The Polled Shorthorn bull came from a prominent herd of the breed located near Ashville, Ohio. He was a choice, thick fleshed bull of good type and had established his merit in the show ring.

The Polled Hereford bull was a superior individual that had made a good record in the show ring. This bull was purchased from a Polled Hereford herd located near Wichita Falls, Texas.

The Aberdeen Angus bull was produced on the Experiment Station farm. While he was never shown, he was equal to the other bulls in type, quality and breeding.

The calves in the high grade lot were all out of high grade Hereford and Angus cows sired by purebred Hereford and Angus bulls, respectively. Most of these calves were produced from high grade cows of the Experiment Station herd, although a part of them were purchased from an outside source for the first test. The above mentioned cows were some which had been graded up from Native stock by the use of purebred sires for several generations.

From the foregoing it will be observed that two general types of cows were used: (1) Native cows; (2) grade cows several generations removed from Native stock. Two types of bulls were used: (1) Native bulls; and (2) bulls representative of leading beef breeds.

It was thus made possible to measure the performance of calves produced from Native cows and Native bulls, of first-cross grade calves from Native cows and purebred beef bulls, and of high grade calves from high grade beef cows and purebred beef bulls.

Care and Management of Breeding Animals

The cows used to produce the calves for this experiment were handled throughout the year as economically as possible. From about the middle of March to the middle of December they received no feed other than that obtained from grazing the Experiment Station pastures. During the winter period these cows were fed on cheap roughages. The total value of such feed did not exceed $5.00 per cow.

To a very large extent, in fact, these cows were wintered on pasture clippings In conformity with standard pasture management practices, the pastures upon which these cows were grazed were

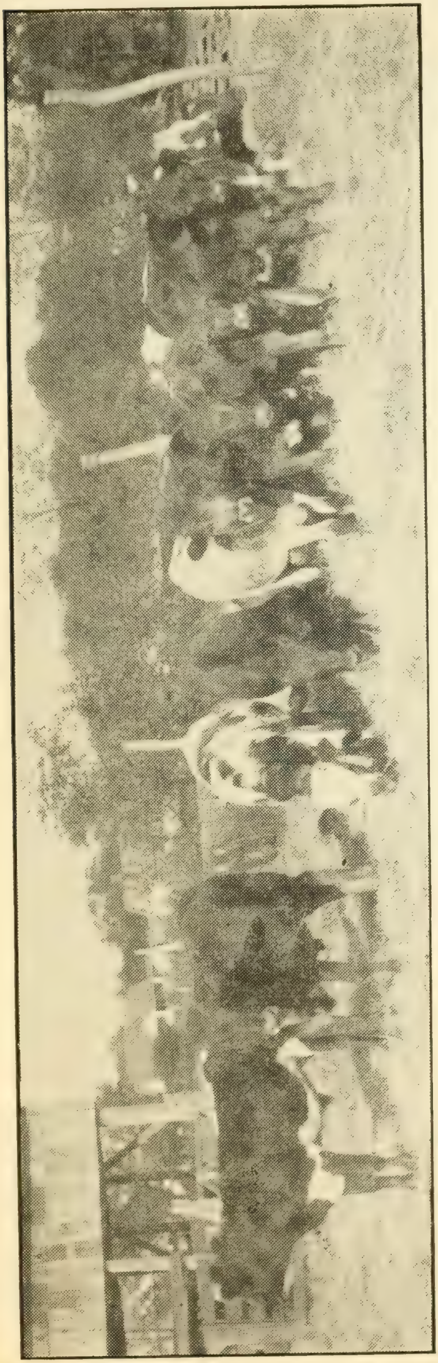

FIGURE 3—CALVES FROM NATIVE COWS AND NATIVE BULL (LOT 1).

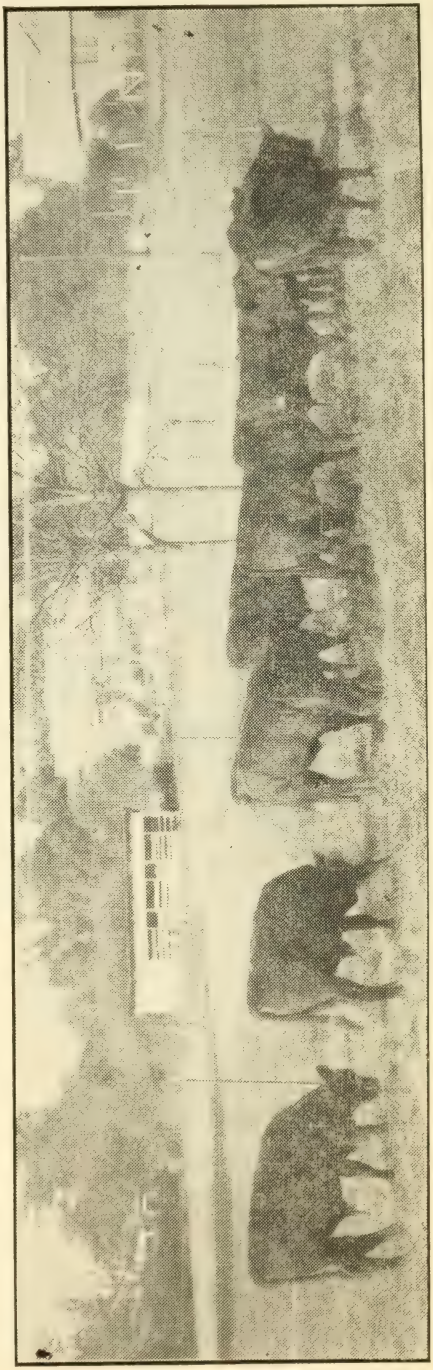

FIGURE 4—CALVES FROM NATIVE COWS AND POLLED DEVON BULL (LOT 2).

clipped or mowed as needed to keep in check both the unpalatable growth of pasture plants and the undesirable weeds. These clippings were stacked in the pasture and enclosed by temporary or improvised barb wire fences. The cows were wintered on the pasture without shelter, and were given access to the clippings or hay as needed by removing the temporary fence. A photograph of one of these hay stacks, together with a group of the Native cows, is shown herewith.

The bulls used in connection with the study were fed in a similar manner except that they received a small amount of grain in addition to roughage during the winter period.

The bulls were turned with their respective groups of cows around the first of June and left there until the first of September. Thus, the cows were bred to drop their calves within a period of about three months the following spring, beginning about the first of March.

THE SUCKLING PERIOD

At the time the calves were dropped they were weighed and given a number according to the Lovejoy system of ear notching. A short time after the last calf was born, all the calves were given a "shot" for blackleg, and all the male calves were castrated at this time. The calves were allowed to run with their dams until the latter part of October at which time they were weaned, weighed, and graded as feeder calves. The separate and combined results of the suckling period of the two tests are shown in table 1, which follows.

Summary of the Suckling Periods

1. With only one slight exception in the case of the Native lot, the performance of the calves during the suckling period of the second test closely approximated the performance of the calves during the suckling period of the first test.

2. The Native lot made a somewhat better showing during the suckling period of the second test than it did during the suckling period of the first test.

3. The high grade calves of both tests combined a greater average weight with a higher market grade and selling price to lead all the lots in average value per head at weaning time.

4. Although the Native calves led the first cross calves in gain from birth to weaning and in weight at weaning, this advantage was more than offset by the higher market grade and selling price of the first cross calves.

5. The Polled Shorthorn calves led the other first cross calves in nearly every respect during the suckling period of both tests, while the Angus calves were last in nearly every respect, with the Polled Hereford and Polled Devon calves running a close race for second and third positions.

6. Under the conditions of this experiment the production of feeder calves in the case of all lots proved highly profitable from the standpoint of a beef cattle enterprise, with the high grade lot being outstanding in this respect.

In a general way this phase of the experiment may be of considerable value to large numbers of Mississippi farmers who desire to enter only the calf production phase of beef production. Such a program commends itself especially to farmers of limited means or who produce limited quantities of grain for feeding cattle. A good pasture is, of course, necessary. Further than that, the requirements are not rigid.

A minimum investment is required for the breeding herd. Substantial income was had from Native cows and a Native bull. There was an increase when a purebred bull of one of the beef breeds was used. There was a still further increase in the value per head at weaning time when grade beef cows and purebred beef bulls were used. Thus, it appears that a farmer may adjust the quality of his breeding herd to the amount of money available. In this event, it appears that a sufficient number of Native cows is preferable to an insufficient number of high grade cows.

The 2-year average value per head of calves at the end of the second period show that the high grade calves were worth approximately $4 per head more than the average of the best lot (lot 3) of the first-cross calves. The average of the four lots of first-cross calves (lots 2, 3, 4 and 5) was $2.15 more than the average value in lot 1 (calves out of native cows sired by Native bulls). In every instance, however—whether Native calves or first-cross calves, or high grade calves—the returns would suggest a very substantial profit under the conditions of this test.

TABLE 1—SUCKLING PERIODS OF GRADE BEEF CALVES, 1938, 1939, AND AVERAGE

	Lot 1 Native Chk. lot	Lot 2 Polled Devon	Lot 3 Polled Shhorn	Lot 4 Polled Heref.	Lot 5 Aberdeen Angus	Av. of lots 2 to 5	Lot 1A High grades
1938 SUCKLING PERIOD							
No. of calves	11	11	11	11	10	...	10*
Av. birth wt., lbs.	65	76	66	67	64	68	...
Av. wt. at weaning, lbs.	415	426	430	408	369	408	429
Av. gain, birth to weaning, lbs.	350	350	364	341	305	340	.....
Av. age at weaning, days	198	196	204	205	194	200	.....
Av. daily gain, birth to weaning, lbs.	1.77	1.78	1.78	1.66	1.57	1.70	..
Av. grade as feeded cattle	Medium	Good+	Good+	Good+	Good+	Good+	Choice—
Value per cwt. as feeder cattle**	6.50	8.00	8.00	8.00	8.00	8.00	8.50
Av. value per head	26.97	34.08	34.40	32.64	29.52	32.64	36.46
1939 SUCKLING PERIOD							
No. of calves	11	12	12	9	10		10
Av. birth wt., lbs.	60	73	66	67	64	68	72
Av. wt. at weaning, lbs.	437	410	418	417	381	407	447
Av. gain, birth to weaning, lbs.	377	337	352	350	317	339	375
Av. age at weaning, days	193	186	192	208	185	193	206
Av. daily gain, birth to weaning, lbs.	1.95	1.81	1.83	1.68	1.71	1.76	1.82
Av. grade as feeder cattle	Good—	Good—	Good	Good	Good—	Good	Choice—
Value per cwt. as feeder cattle**	8.00	8.00	8.50	8.50	8.00	8.25	9.25
Av. value per head	34.96	32.80	35.53	35.44	30.48	33.58	41.35
AVERAGE YEARS 1938 AND 1939							
Av. birth wt., lbs.	62	74	66	67	64	68	*
Av. wt. at weaning, lbs.	426	418	424	412	375	408	438
Av. gain, birth to weaning, lbs.	364	344	358	346	311	340	.....
Av. age at weaning, days	196	191	198	206	190	196	...
Av. daily gain, birth to weaning, lbs.	1.86	1.80	1.80	1.67	1.64	1.73	.....
Av. grade as feeder cattle	Medium+	Good	Good	Good	Good	Good	Choice—
Value per cwt. as feeder cattle**	7.25	8.00	8.25	8.25	8.00	8.12	8.88
Av. value per head	30.96	33.44	34.96	34.04	30.00	33.11	38.90

*No birth record available on this lot for the first test.

**Price based on Bureau of Agricultural economics report for the National Stock Yards, St. Louis, on the respective weaning dates, minus 75 cents per cwt. for marketing.

THE FATTENING PERIOD

At the beginning of the fattening period each calf was given a new number which was branded on its hip. This brand number served for identifying the calves rapidly and accurately throughout the remainder of the test. Stamp irons heated over a small fire were used for doing the branding work.

Feeding the Calves

For about two weeks after weaning the calves were allowed free access to troughs containing hay and grain in order to accustom them to eating these feeds. As soon as the calves were eating fairly well, they were placed on experimental feeding. All the calves were fed in individual stalls and a separate feed record was kept on each calf.

The calves were fed a ration of ground corn, cottonseed cake, lespedeza hay and sorghum silage with oystershell flour and salt as mineral supplements. The corn, cake, and silage were evenly divided between the morning and evening feeds while the daily allowance of hay was all fed in the evening. All the calves received approximately the same daily allowance of cake, hay and silage and this amount was held as constant as possible throughout the duration of each test. The corn, on the other hand, was full-fed, according to each calf's appetite. The average amount of each feed consumed daily is shown in the tables.

The calves in the first trial were fed 177½ days (table 2). Those in the second trial were fed 185 days (table 3).

Weighing the Calves

Individual weights were taken on all the calves on three consecutive days at the beginning and the close of each test; the average of the three weights being the initial and final weights. The calves

TABLE 2—FATTENING PERIODS OF GRADE BEEF CALVES, 1938-1939

	Lot 1 Native Chk. lot	Lot 2 Polled Devon	Lot 3 Polled Shhorn	Lot 4 Polled Heref.	Lot 5 Aberdeen Angus	Av. of lots 2 to 5	Lot 1A High grades
1938-39, 177½ DAYS FATTENING PERIOD							
No. of calves per lot	11	11	11	11	10		10
Av. initial wt., lbs.	415	426	430	408	369	408	429
Av. final wt., lbs.	690	760	728	690	683	715	771
Av. total gain on feed, lbs.	275	334	298	282	314	307	342
Av. daily gain on feed, lbs.	1.55	1.88	1.68	1.59	1.77	1.73	1.92
Av. daily ration*, lbs.							
Ground corn	8.13	8.99	9.01	8.04	8.54	8.65	9.50
Cottonseed cake	2 28	2.36	2.31	2.26	2.36	2.32	2.41
Sorghum silage	4.95	5.83	5.62	5.27	5.51	5.56	5.83
Lespedeza hay	1.47	1.47	1.47	1.47	1.47	1.47	1.47
Av. amt. of concentrates consumed per lb. of gain, lbs.	6.67	6.11	6.69	6.50	6.25	6.39	6.08
Av. cost of feed per 100 lbs. gain	8.82	7.22	8.59	8 74	8.13	8.17	8.01
Av. feed cost per head	24.25	24.11	25.59	24.66	25.54	24.98	27.40
Av. cost of feeder calf	26.97	34.08	34 40	32.64	29.52	32.66	36.46
Total av. cost of feed and feeder calf	51.22	58.19	59.99	57.30	55.06	57.64	63.86
Av. slaughter grade	Medium	Good+	Good+	Good+	Good+	Good+	Choice—
Av. selling price per cwt.**	8.39	9.07	9.13	9.13	9.25	9.15	9.53
Av. selling price per head	56.15	66.86	64.47	61.11	61.28	63.46	71.29
Av. returns per head above feed and calf costs	4.93	8.67	4.48	3.81	6.22	5.80	7.43
SLAUGHTER DATA							
Av. dress per cent (cold wts.)	59.64	60.38	62 04	60.24	60.21	61.8	60.23
Av. carcass grade	Medium	Good	Good	Good	Good	Good	Good+

also were weighed every 28 days during the feeding periods.

Grading Calves and Carcasses

All the calves were graded by a committee as feeder and slaughter animals at the beginning and end of each test, respectively. The carcasses of these calves also were graded after being in the cooler for 48 hours.

Method of Marketing

About a month before the termination of each feeding period all the packing companies in this region having facilities for moving and slaughtering all the calves the same day, and obtaining the desired slaughter data, were advised of the plan to sell the calves in the feed lot to the highest bidder.

Those desiring to bid on the calves were requested to see the calves and place their bids during the three days prior to shipment. It was understood by the bidders that the final weight, less three per cent to allow for shrinkage, would be the selling weight. The calves were to be valued as individuals by each bidder, and the bidder making the highest total bid was to receive the calves.

The splendid cooperation of the different packer buyers who bid on the calves, and of the packing firm that bought and slaughtered them and obtained the complete slaughter data, contributed much to the success of the experiment.

Results

Since two separate feeding periods were involved, three separate tables are presented to summarize results. The 1938-39 results are shown in table 2, and the 1939-40 results are shown in table 3. The average results of the 2 years are shown in table 4.

In calculating the results, the calves were valued at the beginning of the

TABLE 3—FATTENING PERIOD OF GRADE BEEF CALVES, 1939-1940

	Lot 1 Native Chk. lot	Lot 2 Polled Devon	Lot 3 Polled Shhorn	Lot 4 Polled Heref.	Lot 5 Aberdeen Angus	Av. of lots 2 to 5	Lot 1A High grades
1939-40, 185 DAYS FATTENING PERIOD							
No. of calves per lot	10	12	9	8	10		10
Av. initial wt., lbs.	433	416	418	417	381	408	448
Av. final wt., lbs.	688	698	695	681	654	682	747
Av. total gain on feed, lbs.	255	282	277	264	273	274	299
Av. daily gain on feed, lbs.	1.38	1.52	1.50	1.43	1.47	1.48	1.61
Av. daily ration*, lbs.							
Ground corn	6.89	7.24	7.32	6.72	6.78	7.02	8.59
Cottonseed cake	1.97	1.95	1.92	1.96	1.94	1.94	1.97
Sorghum silage	5.61	5.43	5.46	5.54	5.37	5.45	5.68
Lespedeza hay	1.97	1.92	1.99	1.99	1.95	1.96	1.98
Av. amt. of concentrates consumed per lb. of gain	6.42	6.05	6.17	6.08	5.92	6.06	6.54
Av. cost of feed per per 100 lbs. gain	10.40	9.65	9.89	9.87	9.54	9.74	10.29
Av. feed cost per head	26.51	27.21	27.40	26.05	26.05	26.68	30.77
Av. cost of feeder calf	34.64	33.28	35.53	35.44	30.48	33.68	41.44
Total av. cost of feed and feeder calf	61.15	60.49	62.93	61.49	56.53	60.36	72.21
Av. slaughter grade	Med.	Med.+	Med.+	Good—	Med.	Med.+	Good
Av. selling price per cwt.**	8.55	9.35	9.04	9.15	9.08	9.16	9.48
Av. selling price per head	57.12	63.24	60.94	60.48	57.54	60.55	68.72
Av. returns per head above feed and calf costs	—4.03	2.75	—1.99	.51	1.01	.57	—3.49
SLAUGHTER DATA							
Av. dress per cent (cold wts.)	58.49	59.29	58.87	58.11	57.70	58.49	58.56
Av. carcass grade	Medium+	Good—	Good—	Good	Good—	Good—	Good

feeding period at essentially the same amount per head at which they had been valued at the end of the suckling periods, as shown in table 1. Any differences which are noted in these values are due to the small change in the weights of the calves during the two weeks which lapsed between the suckling and fattening periods of the test. Feeds fed to the calves throughout both fattening periods were valued at average market prices, regardless of whether such feeds had been produced on the Station farm or purchased. The selling price per hundredweight of the calves was the actual price obtained as described under "Methods of Marketing". No charge was made for labor used in feeding, it being usually considered in experimental work that the value of manure produced is approximately equal to the value of labor used in feeding.

The feeding phase of the experiment is more directly applicable to farmers of Mississippi who are in position to produce surplus quantities of grain, silage and hay, with the idea of marketing such feedstuffs to best advantage through livestock. On this basis, ground corn produced in 1938 was marketed through the calves at 60 cents per bushel, and the 1939 corn at 75 cents per bushel;

TABLE 4—FATTENING PERIODS OF GRADE BEEF CALVES, 2-YEAR AVERAGE

	Lot 1 Native Chk. lot	**Lot 2 Polled Devon**	**Lot 3 Polled Shhorn**	**Lot 4 Polled Heref.**	**Lot 5 Aberdeen Angus**	**Av. of lots 2 to 5**	**Lot 1A High grades**
AVERAGE, 1938-39, AND 1939-40							
Av. initial wt., lbs.	424	421	424	412	375	408	438
Av. final wt., lbs.	644	729	712	686	668	698	759
Av. total gain on feed, lbs.	265	308	288	273	294	290	320
Av. daily gain on feed, lbs.	1.46	1.70	1.59	1.51	1.62	1.60	1.76
Av. daily ration,* lbs.							
Ground corn	7.51	8.12	8.16	7.38	7.66	7.84	9.04
Cottonseed cake	2.12	2.16	2.12	2 11	2.15	2.13	2.19
Sorghum silage	5.28	5.63	5.54	5.40	5.44	5.50	5.76
Lespedeza hay	1.72	1.70	1.73	1.73	1.71	1 72	1.72
Av. amt. of concentrates consumed per lb. of gain	6.54	6.08	6.43	6.29	6.08	6.22	6.31
Av. cost of feed per 100 lbs. gain	9.61	8.44	9.24	9.30	8.84	8.96	9.15
Av. feed cost per head	25.38	25.66	26.50	25.36	25.80	25.83	29 08
Av. cost of feeder calf	30.80	33.64	34.96	34.04	30.00	33.17	38.95
Total av. cost of feed and feeder calf	56.18	59.34	61.46	59.40	55.80	59.00	68.04
Av. slaughter grade	Medium	Good	Good	Good	Good	Good	Good+
Av. selling price per cwt.**	8.63	9.21	9.08	9.14	9.16	9 16	9.50
Av. selling price per head	56.64	65.05	62.70	60.80	59.41	62.00	70.00
Av. returns per head above feed and calf costs	.45	5.71	1.24	2.16	3.62	3.18	1.97
SLAUGHTER DATA							
Av. dress per cent (cold wts.)	59.06	59.84	60.46	59.18	58.96	60.14	59 40
Av. carcass grade	Medium	Good	Good	Good	Good	Good	Good+

*1/10 lb. oystershell flour fed per head daily during this period.

**Actual price paid for calves on final wts. minus 3 per cent to allow for shrinkage, F. O. B. State College.

Feed Prices: 1938-39	**1939-40**
Ground corn $.60 per bushel	Ground corn $.75 per bushel
C. S. cake $25 per ton	C. S. cake $27 per ton
Sorghum silage $4 per ton	Sorghum silage $4 per ton
Lespedeza hay $12 per ton	Lespedeza hay $12 per ton
Oystershell flour $1 per cwt.	Oystershell flour $1 per cwt.
Salt $1 per cwt.	Salt $1 per cwt.

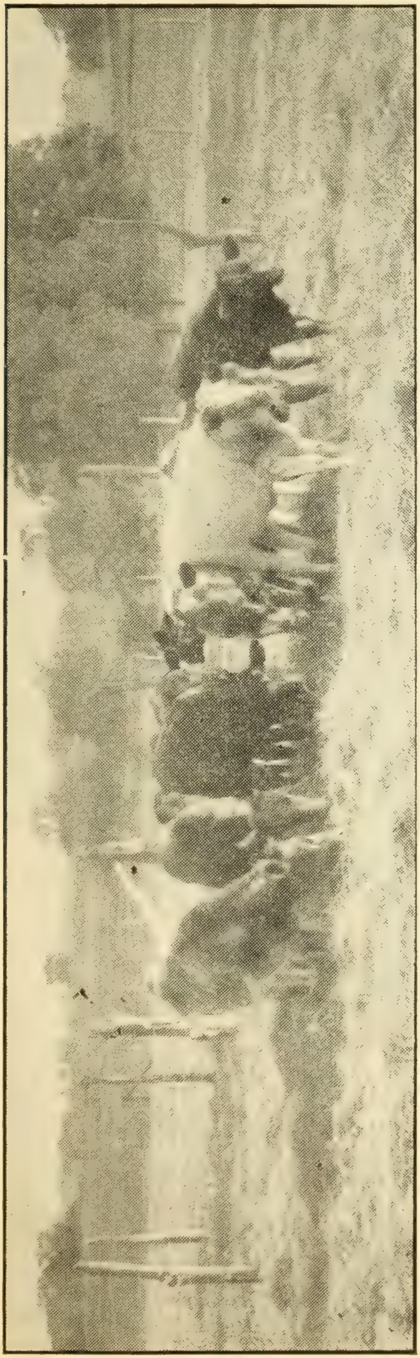

FIGURE 5—CALVES FROM NATIVE COWS AND POLLED SHORTHORN BULL (LOT 3).

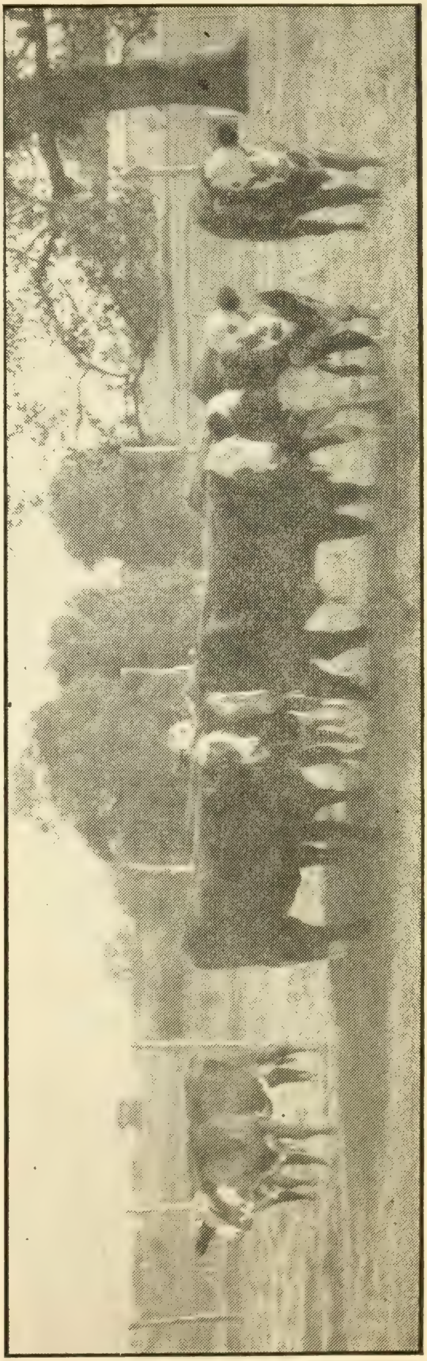

FIGURE 6—CALVES FROM NATIVE COWS AND POLLED HEREFORD BULL (LOT 4).

sorghum silage was marketed through the calves at $4 per ton during both feeding periods, and lespedeza hay was likewise marketed during both feeding periods at $12 per ton. Cottonseed cake, oyster shell flour and salt were purchased and were charged to the calves at the purchase cost.

In addition to the sale of farm produced feedstuffs at the specified price, the calves yielded 2-year average profits per head, as follows: lot 1, Native, 45 cents; lot 2, first-cross Polled Devons, $5.71; lot 3, first-cross Polled Shorthorn, $1.25; lot 4, first-cross Polled Herefords, $2.16; lot 5, first-cross Aberdeen Angus, $3.62; and lot 1A, high grades, $1.97.

It was previously noted that at the end of the suckling period the average value per head of two crops of first-cross calves out of native cows and sired by beef type bulls was $2.15 more than the value of calves out of Native cows sired by a Native bull.

The influence of the beef sires was further emphasized in the fattening period.

The average return per head above feed and calf costs for the Native calves out of Native cows sired by a Native bull was 45 cents; the average return per head above feeding and calf costs of the Devon, Shorthorn, Hereford, and Aberdeen Angus first-cross calves was $3.18. This would indicate an additional gain per calf attributable to the purebred beef sires of $2.73. Adding the gain reported for the suckling period, the total gain per calf attributable to purebred beef type sires is $4 88 when both suckling period and fattening period are considered.

Summary of the Fattening Period

1. The performance of the calves in general during the fattening period of the second test was less satisfactory than the performance of the calves during the fattening period of the first test. This is explained at least in part by the fact that the calves in the second test suffered severe set-backs due to the unusually cold weather of the past winter, as well as the result of a two weeks' attack of coccidiosis during which nearly every calf in the group went off feed.

2. The superiority of the calves with improved breeding over the Native calves for producing beef efficiently and economically on the ration fed is brought out by the results of the two tests.

3. The superiority exhibited by the high grade lot over the other lots during the first test was not apparent in the results of the second test.

4. The Polled Devon group led the other first cross lots in returns above feed and calf costs for the fattening periods of both tests, with the Angus lot holding second position in each case.

5. It is of interest to note that one Native, one Hereford, and three Shorthorn heifer calves had to be removed from the experiment during the fattening period of the second test due to pregnancy. This means that these calves were bred at less than six months of age by the mature bulls of their respective lots before the bulls were separated from the cows and calves around the first of September.

GENERAL CONCLUSIONS

From the data available for both the suckling and fattening periods of the two tests, it is apparent that:

1. The use of good purebred beef bulls for siring beef calves from Native Mississippi cows is to be recommended.

2. A good purebred bull from any of the leading beef breeds may be used to advantage for this purpose.

3. The continued use of good purebred bulls of a specific beef breed for building toward a herd of high cows, using Native cows as the foundation stock, is a highly desirable practice.

4. Beef cattle production is a very practicable enterprise for supplementing the growing of cotton and other crops on many Mississippi farms.